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Reducing Polishing Costs by Tumbling

By GEORGE S. BRADY

TUMBLING, or barrel rolling, for the purpose of polishing and "coloring" metal parts, is one of the oldest mechanical processes, yet in its aspects as a mechanical art it is one of the newest. Some of the old-line New England novelty and notion manufacturers have been employing tumbling for such articles as safety pins and eyelets for half a century, but it is only within the last eight or ten years that tumbling has been taken up generally as a finishing method, and only since the beginning of the present business depression that managements have recognized the art involved and its adaptation to an infinite variety of parts for all kinds of products.

Examining into the vast literature of metal finishing I find very little published data on tumbling, and practically no specific information on the classification of work to suit the different types of barrels, abrasives, and other variables. In no place do I find the process put down in a system of rules of skill, or as an "art."

The quickened interest in tumbling during the past three years has arisen from the desire to eliminate or lessen the comparatively expensive hand operation of polishing, which on castings is frequently very costly. This drive to save hand labor during a period when many operators are unemployed has been a strange paradox of the present depression, but it is a recognized fact in the progress of the machine age, and will eventually be met by measures which are outside the field of discussion of this article.

A few years ago there were quite definite lines drawn in regard to

USE of the tumbling, or barrel rolling, process for polishing and "coloring" metal parts has increased, especially during the past three years, because of savings it makes possible in eliminating or reducing hand-polishing operations. Successful application involves consideration of a number of variables, many of which are discussed in this article. The information given covers both dry tumbling or coloring and wet rolling.

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what class of parts or pieces were adaptable to labor economy by tumbling. But at the present time there is no dividing line, and every day sees new parts finished by this method. As in the practice of any other art, the fundamentals consist in the recognition of the variables, and the application of proper skill to these variables to produce the desired results. In commercial production tumbling there are the following variable factors:

- 1—Size and shape of piece
- 2—Kind of metal
- 3—Nature of finish desired
- 4—Type of barrel to use
- 5—Kind of abrasive to use
- 6—Speed of the barrel
- 7—Quantity of work in the barrel
- 8—Time required in barrel.

It is no more possible to give a set of rules to cover the first three items than it would be to try to give definite rules for the blending of colors to produce an effect on a painting. Every individual part to be finished by tumbling requires separate analysis, and having once established the operations for a part they should be entered on the operation or routing cards in the same manner as the detailed heats and quenching media for the heat-treatment of steels. In plants where hundreds of different parts are passing through the polishing department it is not sufficient to designate the operation merely as "tumble."

Sheet Metal and Screw Machine Parts Prepared for Plating

Small sheet-metal parts made of cold-rolled steel or of rolled brass, or screw-machine products turned from drawn metals, almost always have surfaces free from heavy scratches and are satisfactory for plating if an even shine or "color" can be produced uniformly over them. Except for the cheapest class of work, "coloring" by an acid pickle is not satisfactory because the acid accentuates the roll lines or tool marks. This class of work, therefore, constitutes the first group of application to tumbling.

To obtain rapid results and an even "color" in tumbling on sheet-metal and screw-machine work it is necessary to eliminate bad tool marks, which is easily accomplished if brought back to the source. Since this class of coloring is usually done only with dry sawdust or leather shavings as the abrasive, it is not possible to

polish out the tears caused by tight forming tools, the burrs from dull blanking dies, or the deep scratches caused by dull cutting tools. But by referring this bad work back to the manufacturing departments actual economies have been obtained as well as better work by the resulting improvement in the tools. The increased use of tumbling has thus many times resulted in improving workmanship in the whole plant.

Dirty Sawdust Will Leave Blemishes

If the above class of work is oily it is given a short 10 or 15 min. tumble in old sawdust to remove the oil, since dirty sawdust in the finishing operation will leave blemishes that will later show in the plate. Only new, clean sawdust is used for finish tumbling. This material is a special hardwood sawdust, usually maple, sold to the metal-finishing trade. The use of scrap sawdust from the woodworking department is not advisable as a general practice. The amount of sawdust employed in the barrel depends upon the shape and size of the parts, and should be only sufficient in quantity to cushion the pieces to prevent scratching. Clean, dry, fine sand may also be employed for "color" tumbling.

For ordinary dry tumbling or coloring 4 to 6 hr. tumbling in a standard tilted barrel at about 30 r.p.m. is sufficient, but for high coloring a much longer period of time may be required. Experimentation is necessary to determine the proper amount of sawdust, as the proper proportion to suit the shape of the piece will help to shorten the time of tumbling. Screws and screw-machine parts that have been nicely machined can be brought to a fine finish in less than 2 hr. of tumbling if enough sawdust is used to prevent the pieces from tumbling on themselves. The speed of the barrel can be brought up to a point just below that at which centrifugal force would act to whirl the mass together. For parts having fine threads or small holes a fine grade of sawdust is required to prevent clogging in threads, slots or holes. Links and formed wire parts are very adaptable to dry sawdust tumbling, it being only necessary to govern the quantity in the barrel and the amount of sawdust to prevent hooking together and bending. It must be remembered that dry sawdust tumbling is essentially a "coloring" operation, and although applicable to a vast variety of work, is not a process that will remove burrs or heavy scratches.

Factors Governing Wet Rolling of Small Parts

An important consideration in sheet-metal and small-parts tumbling is that of wet rolling. Two factors govern the requirements of this process as apart from the cheaper method of coloring by dry tumbling; i.e., shape of the piece and degree of polish. Sheet-metal pieces having considerable flat area require a grinding

or burnishing that cannot be produced dry. Small parts whose outside position on the product calls for a smooth high polish must also be burnished in the tumbling process. But wet rolling will kill the original finish of rolled brass or steel parts, and a dry sawdust tumble may be necessary as a second operation.

For wet rolling the liquid burnishing medium consists of a solution of potash, soap, sodium cyanide, cream of tartar, or one of the proprietary cleaning compounds. Most screw-machine parts and formed-wire parts are of a nature that permit rolling on themselves in the solution without the use of any solid abrasive. But larger pieces, especially sheet-metal parts with flat surfaces, require the use of abrasive powder, sand, or other burnishing material. Frequently, the addition of pumice or emery to the solution is sufficient to remove burrs and tool scratches, but the larger pieces require balls to act as a rolling cushion. Considerable skill and judgment are needed in the determination of the best rolling media.

Punchings, as Well as Round Balls, Employed

Commercial balls for rolling are marketed in a number of sizes from 1/32 to 1/2 in. in diameter, but generally two sizes are sufficient for the work of the average plant: the 3/32 in. size for small parts and the 5/16-in. size for larger parts. In plants where there are large quantities of small punchings produced as scrap material these punchings are used instead of balls and have advantages over the round balls for many types of parts. It is the custom to use steel punchings for brass parts and brass punchings for light steel parts. Irregular-shaped punchings can be employed, and in the tumbling of heavier steel pieces, such as forged gun parts, iron "jacks" and pebbles may be used. The proportion of balls or punchings to be used depends upon the size and shape of the parts being tumbled, and can only be determined by experimentation. While some parts will burnish by rolling on themselves with few or no balls, others require sufficient balls to keep them from hitting and scratching and to eliminate "nesting." The amount of liquid in the barrel for wet rolling is only sufficient to cover the work.

The proper speed of the barrel for wet rolling depends upon the bulk and weight of the part, and should be below the point of centrifugal effect. Barrel speeds vary from 20 to 50 r.p.m., and must be determined in-

dividually for each part. Some plants do a great amount of rolling for periods of upwards of 24 hr., but it will be found possible to reduce these times greatly by devoting time to experimentation with quantities, abrasives, liquid and speeds. Fine abrasive, or even sawdust added to the solution, is sometimes effective in reducing the time necessary to obtain a high polish. In other cases the total time may be reduced by changing progressively from one tumbling to another of different solution and abrasive.

Oblique Barrel Popular for Wet Rolling

The "oblique" barrel, that is, a barrel operated at approximately a 25 or 30-deg. tilting position, has become the most popular for the wet rolling process, as it is stated that the horizontal barrel is too "abusive" for many parts. While the oblique barrel gives a two-way rolling action, the horizontal barrel gives a one-way throwing motion.

The oblique barrels are usually of wood, and are octagon in shape to aid the tumbling action. However, it is the opinion of some experienced operators that the older type of horizontal barrel has been too hastily abandoned before the art of correct combination was understood. One of the largest New England users, whose polishing operations embrace several thousand different parts of widely varying nature, has had remarkable success with the horizontal steel and cast-iron barrel run at fairly high speeds. This plant does not attempt to complete the tumbling operation at one load, but breaks it down into two or more separate operations with different abrasive solutions. Although this method requires more handling, a finer polish is obtained in less time.

"Cut-Down" Rolling of Castings

"Cut-down" rolling as a first tumbling operation on castings is a process that has served to eliminate a large amount of hand polishing. The horizontal barrel is generally used for this work because the parts can ordinarily withstand severe tumbling. Balls, punchings, pebbles, iron "shot," or "jacks" are used to assist the cutting down of the scale of the castings. Parts of different sizes and shapes can be mixed in the same barrel, and by their action on one another will perform the same operation as the ball or slug.

The second operation in the tumbling of castings is the rolling in sand. The abrasive material used is the ordinary coarse builders' sand with enough water added to form a paste or heavy mud. It will be found that bulky parts are likely to ride around in the barrel without much tumbling, and some experience is needed to determine the most efficient speed of barrel for each type of part. The ordinary speed for oblique barrels is

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What the Machine Has Done to Us

By WALTER S. GIELE

BEFORE proceeding to the detailed discussion of the specific data applying to the various phases of the manufacturing industry, it may be well to take a general view of the character of the data.

The period of the collection and compilation of the census data does not coincide with the period of the business cycle. The census data are gathered at regular intervals, but the recurrent phases of the business cycle, being the net resultant of innumerable and divergent factors, occur at irregular intervals. Col. Leonard P. Ayres, in his *Chart of Business Activities*, records no less than 19 periods of subnormal activity of varying duration and extent within the time interval covered by the present study. It follows, therefore, that the data of some of the census years must have been gathered in a period of abnormally high business activity and of other census years in a period of subnormal business activity. If, then, a clearly defined rate and direction of movement be revealed in the charted data there is indicated what is most probably a basic trend which underlies and carries through the impact of the cyclical change. The evidence of fundamental trend will be especially strong if the charted lines exhibit a tendency to fall back into the trend path after having been diverted by the effects of abnormal conditions.

The fitting of trend lines and of formulas to time series of data has been developed as a mathematical process in the statistical method. Where the series is known to follow a fixed law such mathematical methods are exact. The accumulated amount of principal plus interest for a sum of money at a fixed rate compounded at fixed intervals furnishes an example of a phenomenon that follows a fixed law. It can be plotted and a curve or a formula can be fitted precisely by exact mathematical methods. Such a curve can be extended (projected, extrapolated) in either direction to any degree.

The data with which we have to deal, however, follow no such precise mathematical pattern. They repre-

sent, in fact, the net results of countless variable influences, which follow no fixed laws with respect to themselves or to each other. Under these conditions no precise mathematical method is warranted or here attempted. Where, however, the magnitudes in a series show an unmistakable tendency, a trend line may be suggested by inspection alone. Within the time limits of the data, general direction and either acceleration or retardation in the rate will be pretty clearly indicated. Even though exact time and exact extent may not be calculated, reasonably certain inferences may be drawn as to the approach to upper or lower limits and possible reversals of direction. The discussion of the fitting of trend lines is fully covered in Mills' "Statistical Methods," page 288.

Changes in Growth of Industrial Employment

During the earlier development of this country's manufacturing industries the number of wage earners employed in those industries increased at a rapid pace, following very nearly a geometrical progression. That is to say, each year's increase in numbers

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THIS is the third article in the series by Mr. Giele in which he presents a factual study of the long-term records and relationships of mechanization, wages and employment. Preceding articles appeared in THE IRON AGE of Feb. 2 and 16.

In this chapter the author develops the fundamental trends in employment and wages in the manufacturing industries and deduces from them that we were approaching, even prior to the depression, a stationary rate of increase in employment but not of wages.

was a nearly constant percentage of the total number employed at the end of the preceding year, from 1849 to 1889. The increase was rather faster than the average rate under the stimulus of the Civil War in the decade from 1859 to 1869, and rather slower in the next decade, which included the long depression of the 1870's. During this total period of 40 years, the growth of manufacturing industry absorbed an ever-increasing proportion of men from the forests and farms, the gain in industrial employment being 345 per cent as against a gain of but 165 per cent in population.

The depression of the 1890's brought an abrupt change of trend in employment even though there were more wage earners employed in manufacturing industries in 1899 than there had been in 1889. The first decade of the new century, however, saw a resumption of industrial expansion accompanied by a world-wide rise in commodity prices, and the increase in factory employment resumed its former rate.

The five-year period from 1909 to 1914 was marked by many events disturbing to business sentiment, culminating in the panic following the outbreak of the World War in the latter year. Industrial employment during the five-year period from 1909 to 1914 fell back to the rate of growth characteristic of the 1890's, being considerably influenced by the many strikes that marked this period. The period from 1914 to 1919, including as it does the "war era" and the post-war boom, is marked by a rate of increase in industrial employment only very slightly faster than the rate of increase during the first decade of the century.

The sharp post-war depression is reflected in the sharp drop in employment in 1921. By 1923 employment had very nearly regained its 1919 peak in number of wage earners, a level which was approximated in 1929, though 1931 showed a level of employment lower than that of 1921.

The departure from the uniform percentage (straight line) rate of in-

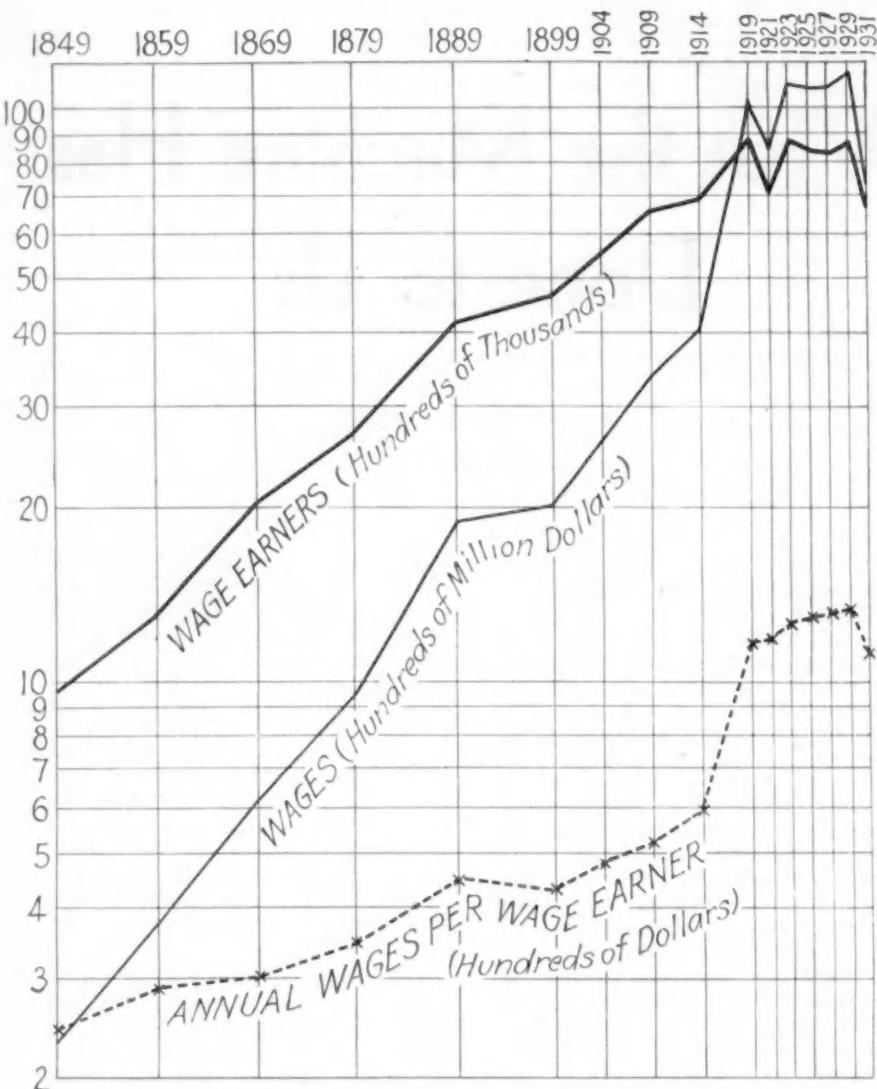


Chart 11—Growth of total wages and number of wage earners in our manufacturing industries and record of individual annual wages

crease which became evident after 1889 is now revealed as a permanent change in characteristic and seems very clearly to point to an approach to an upper limit. Such an approach to or attainment of the upper limit in numbers employed in manufacturing industries does not, however, of necessity forecast an alarming condition of unemployment. It may indicate merely that, with a total population rapidly approaching a stationary rate of growth, the great industry groups will approach a state of equilibrium in which there will be a nearly constant distribution of occupations. Agriculture, the oldest industry, has probably passed that state of equilibrium. It seems logical to expect that the manufacturing industries would be the next to reach it.

The aggregate wages paid to the wage earners in manufacturing industries, like the number of wage earners, exhibits an almost uniform rate of growth in geometrical progression from 1849 to 1889, but the rate of growth of wages is faster than the rate of growth of wage

earners. It is here to be noted that this aggregate includes all wages paid to all wage earners in manufacturing industries, and thus evens out the disequilibrium between industries and occupations.

The depression of the 1890's brought a change in the rate of increase in wage payments more abrupt than the change in the rate of increase in wage earners, but the entire 15-year period from 1899 to 1914 shows substantially the same rate of increase as did the 40-year period from 1849 to 1889.

The first decade of the new century was one of bumper crops and high crop prices so that, there being little incentive to leave the farm, the factory labor supply was not so urgently augmented from the ranks of farm laborers, and an approximate equilibrium was reestablished between demand and supply.

The sudden halt in immigration from the European countries involved in the war, followed by the removal of millions from the ranks of industrial employees for military and naval service with our own entry into the conflict,

combined with enormous demand for munitions and supplies, completely upset that equilibrium. The aggregate of wage payments fairly shot upwards from 1914 to 1919. The intersection of the lines of wage earners and wages on the chart has no significance other than that the average annual wages per wage earner passed the one thousand dollar mark at that point.

The depression of 1921 brought a reduction in wage disbursements as payrolls were reduced with the reduction of working forces, but 1923 saw a total higher than that of 1919 to be exceeded in turn by the total of wage disbursements in 1929.

No Permanent Change in Wage Trend Indicated

The abrupt drop shown for 1931 in both wage earners employed and wages paid will, in all probability, be extended through 1932 and possibly not materially raised in 1933. There is, however, nothing in the data so far available to indicate that this is different in kind from the sharp drop shown in 1921, though greater in extent and duration.

There is surely nothing in the accumulated data of 80 years' experience to indicate that the lines will not return to the level of the suggested trend.

Wages per wage earner as here computed and charted are the average annual money wages per wage earner employed in manufacturing industries.

As such the figures eliminate the effects of discontinuity of employment, and are independent of variations in hours worked and hourly rates of wages. They represent an average for all of the manufacturing industries. They do not reflect the experience of the individual as it may be influenced by locality, industry or occupation and apply only to those employed. They do reflect the amount of money the average wage earner received in wages for the year.

As the census figures for 1859 were collected two years before the outbreak of the Civil War and those for 1869 four years after its close they do not reveal a probable temporary rise during the war period. There is, therefore, indicated a steady rise from 1849 to 1889. The lower demand for workers in proportion to the potential



supply in the depression decade of the 1890's is reflected in a wage per wage earner lower in 1899 than in 1889; after which the increase was resumed at a somewhat faster pace than before.

In the period from 1914 to 1919, however, with the sudden and abnormal disturbance between the supply of and the demand for labor already noted, there occurred in the average wage per wage earner the most violent shift noted in any of the series considered in this study. The annual wage was practically doubled in this period, rising from \$590 in 1914 to \$1,163 in 1919. During the 65-year period from 1849 to 1914 the annual rate of increase adheres quite closely to a trend line representing a geometrical progression at the rate of 1.36 of one per cent per year.

While there were some wage readjustments during the post-war depression of 1921, the average rate of annual increase was but little disturbed and for the decade from 1919 to 1929 shows an almost exact adherence to a straight trend line parallel to the trend preceding 1914. There seems to have occurred not so much a change of trend as an offset in the trend line. The single offset, however, is equivalent in effect to the entire accumulated increase from 1859 to 1914.

Current Wage Decline a Temporary Dislocation?

The abrupt decline in average annual wages per wage earner in 1931 reflects part-time employment rather than reduction in wage rates. More will be written of this in connection with real wages and the cost of living.

John H. Van Deventer, editor of THE IRON AGE, suggests that the over-expansion of manufacturing equipment and the over-expansion of markets were not the choice of industrial management. It was, perhaps, the result of an effort to meet the condition of a war-time wage scale in a world otherwise on a peace-time level by increasing the rate of turnover.

The 1921 depression had gone far in the readjustment of the commodity price levels, but had no permanent effect on the price of labor. The effort was to meet the depressed selling price by a reduction of unit labor cost without a reduction of wage rates.

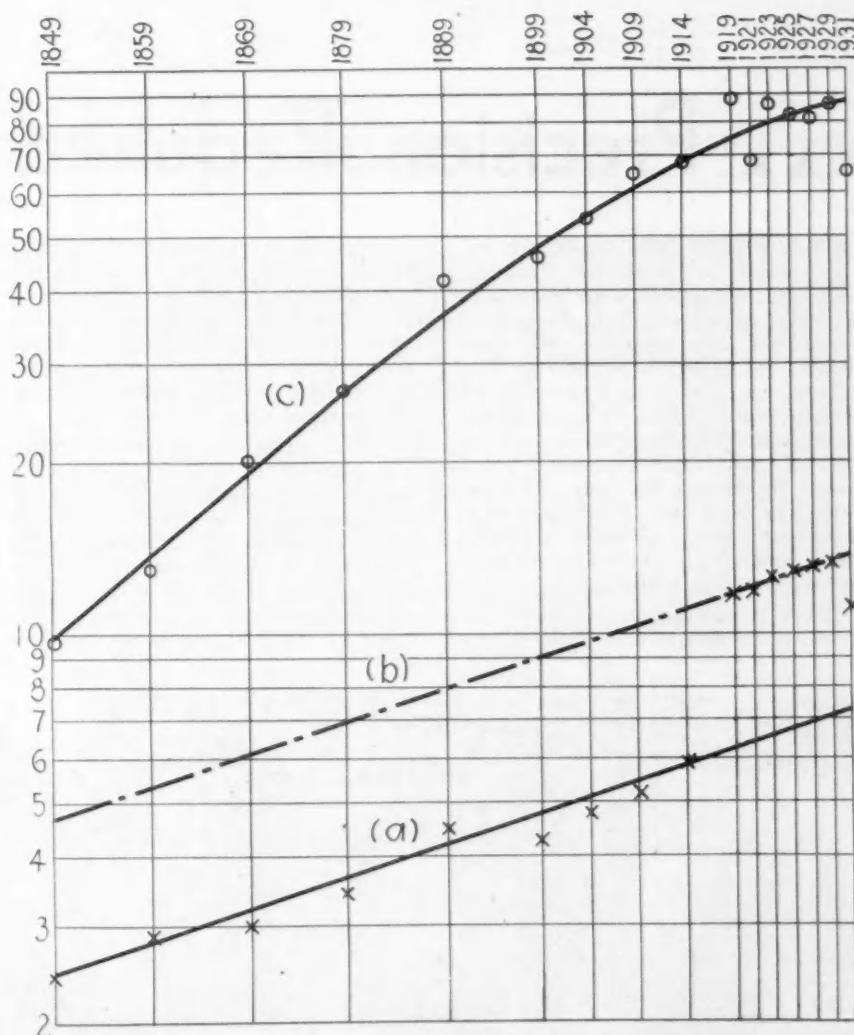


Chart 12—Trend lines of employment and individual annual wages in the manufacturing industries. Lines *a* and *b* show the remarkable similarity in wage trends for pre-war and post-war periods, in spite of the sudden shift to higher level in 1919. Scale reading is hundreds of dollars. Curve *c* shows the probable trend of employment in the manufacturing industries, expressed in hundreds of thousands of wage earners

This was not and is not a battle in the once traditional war between "capital" and "labor." It is a battle in the eternal war between the buyer and the seller, a war among the great occupational groups each of which is buyer from all others and seller to all others.

No Group Can Receive Disproportionate Share

In this war capital and labor in any one industry are like army and navy of one nation, two branches of service united in one cause. All consumers, be they wage earners in or owners of enterprises, are buyers of the products of other industries. Neither wage earners nor owners of one group of enterprises can receive a disproportionate price for their services or goods except at the expense of both wage earners and owners of other enterprises in other groups.

To sum up, the number of wage earners engaged in the manufacturing industries would seem to be approach-

ing or to have reached a stationary rate of increase. This fact does not of necessity imply an alarming and permanent condition of unemployment but may indicate, rather, an approach to an equilibrium with a stationary rate of increase in population growth.

The average value of money wages per wage earner has shown a remarkably uniform rate of increase throughout an 80-year period but including a remarkable offset without change in rate of increase.

Current drastic reduction of annual earnings through unemployment rather than through reduction of wage rates in the manufacturing industry may, in considerable degree, be a result of this extraordinary dislocation.

Michigan State College, East Lansing, Mich., is planning to give a short course in foundry work on April 6, 7, and 8. Registration fee for the course will be \$5.

▲▲▲ Precision Required in Machining Nic

TRANSMISSION gears are required to withstand heavier loads and more wear than perhaps any other part of an automobile. In view of these severe service conditions, the Packard Motor Car Co., Detroit, has used a case-hardening 5 per cent nickel steel for its gears, notwithstanding the fact that it entailed unusual gear manufacturing processes. In the last five years the company has made and installed in new cars more than 1,078,400 of these gears, and of this large number very few have had to be replaced.

Helical transmission gears of the same hard steel are now made by the

against which the transmission gear rests. The gear, having a splined bore, is secured in the head by placing it on a mandrel, the protruding end of which is inserted in the bore. While thus centered, the gear is clamped against the shoulder and the centering mandrel removed.

For grinding the top of the spline, a device at one side of the head is mounted on a pedestal which has a transverse slide carrying a bearing in which a high-speed spindle is mounted. The inner end of the spindle carries the grinding wheel. The spindle is moved in and out of the bore of the work by reciprocation of the table on

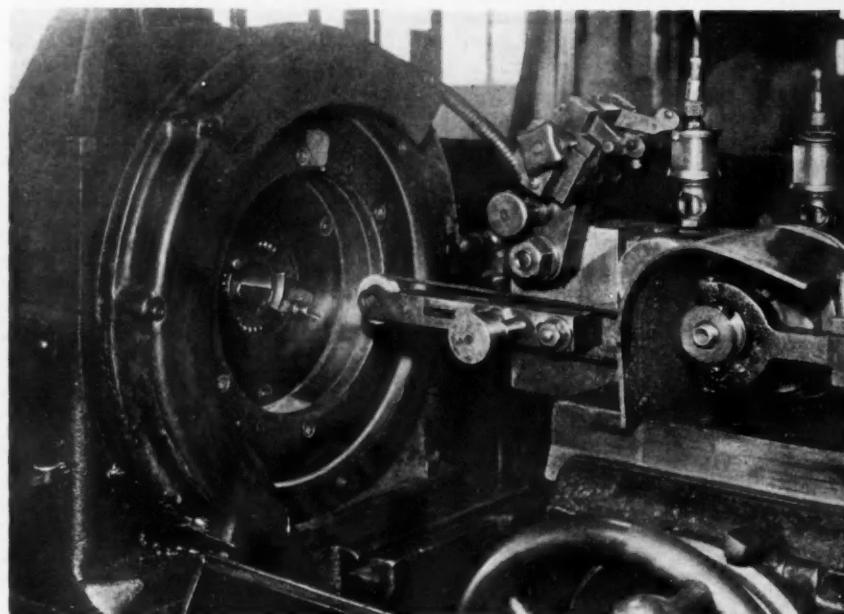
which the device rests. When the top is ground within proper limits, the wheel for grinding the sides of the splines advances from the opposite side of the workhead which holds the gear. The machine is equipped with a special indexing mechanism by which the workhead is moved into predetermined position and locked. After the sides of the homologous splines have been ground and the work has been rotated through one complete revolution, the gear is revolved again through similar steps during which the other sides of the splines are ground. The special grinding wheel spindle acts as its own pulley.



AFTER heat treatment, transmission gears are lapped to remove any distortion. Lapping machines are of the vertical type and gears are lapped an average of 50 strokes. At the right of each operator is a sound-proof room where gears are mated and tested.

company. These require uncommon precision in machining, but transmissions equipped with them provide quiet operation with high strength and wear resistance. The helical gears require more than double the work necessary for producing the straight tooth gears. An important feature is the grinding of the interior splines to assure proper fit of the gears on their shafts. This is done on a grinding machine equipped with a special device by which the tops and sides of internal splines are ground within close limits with a single setting of the work.

At the end of the power-driven reciprocating table are pedestals which constitute tool supports on which grinding devices are mounted. The work-supporting head, consisting of a pair of concentric sleeves, is mounted on a pedestal attached to a stationary bridge in the middle of the machine. Within the inner sleeve is a work-holding member having an axial bore and a counterbore in one end forming a circumferential ledge or shoulder



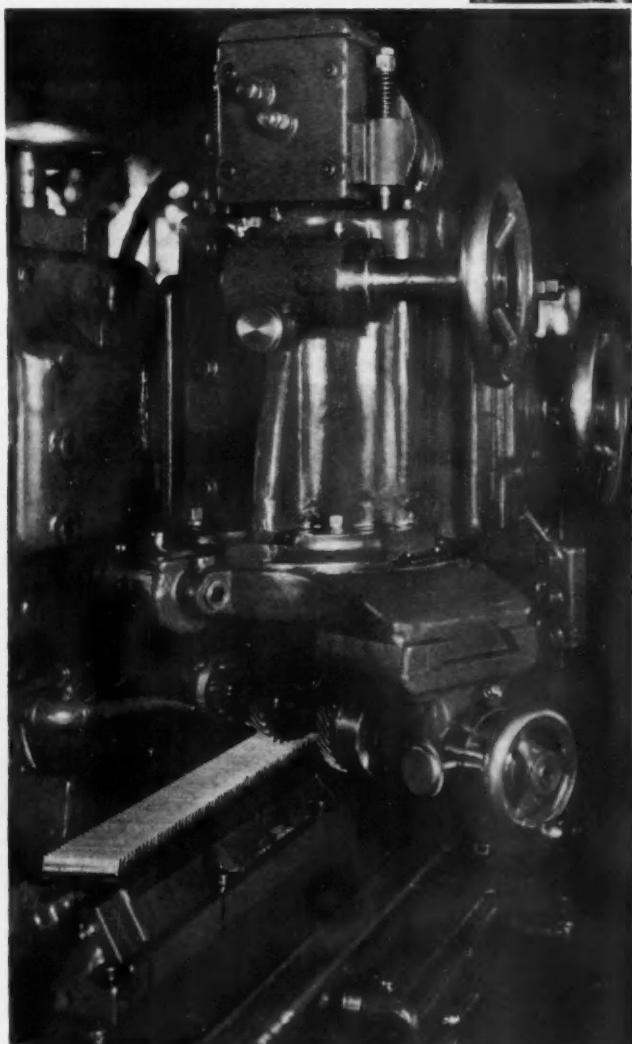
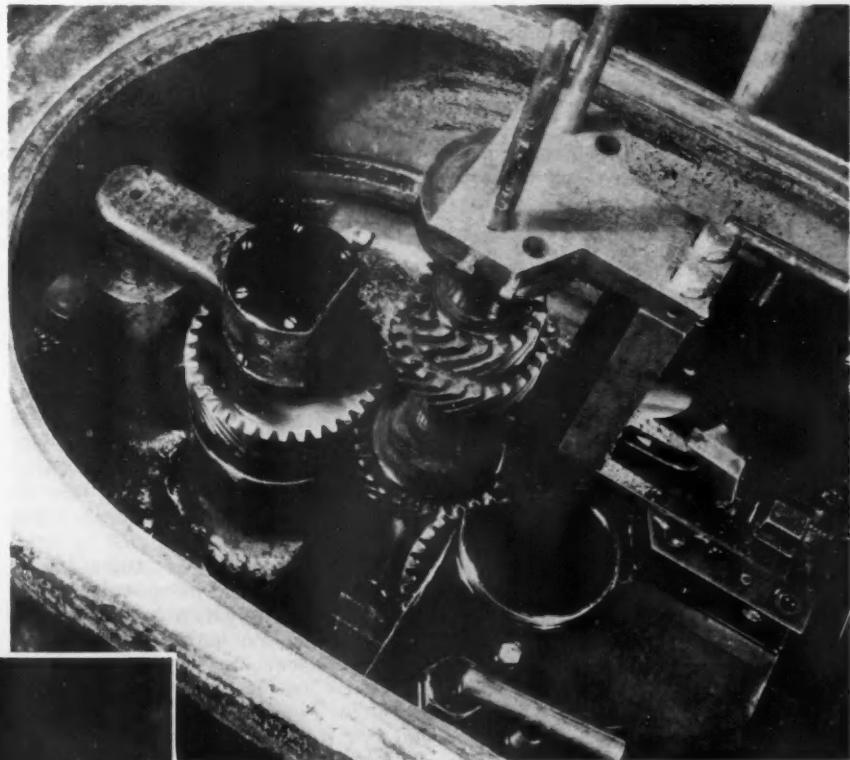
Interior splines are ground to assure proper fit of the gears on their shafts. The tops and sides of the splines are ground within close limits in a single setting of the work.

ng Nickel-Steel Helical Gears

By BURNHAM FINNEY

Before gears are heat-treated and hardened, they are put through a "shaving machine" which removes approximately 0.005 in. of stock from the teeth. The machine is hydraulically operated, high pressure being used for power on the table travel, while a low pressure cylinder mounted on top of the head raises and lowers the head and locks the machine to the correct finishing dimension. The machine is controlled by a single lever. The operator puts the gear on an arbor and pushes the lever, which starts the table traveling automatically, the head coming down to a predetermined position. On the table is a cutting rack with 62 teeth, which machine the gear teeth. After the table makes 50 strokes, the head automatically raises and the table stops.

There are two arbors, one of which is loaded while the other is holding a gear for the finishing operation. At the side of the machine is a special



BEFORE heat treatment, the gears are burnished on a gear burnishing machine.

PRIOR to being hardened, gears are put through a hydraulically-operated "shaving" machine which removes 0.005 in. of stock from the teeth. The gear is held on an arbor, and the table, with a cutting rack having 62 teeth, makes 50 strokes during the machining cycle. The machine handles three 25-tooth 10-pitch, $\frac{3}{4}$ -in. face gears per min.

place to hold the arbor not in use and to drain the dripping oil into the oil tank in case the arbor has just been removed from the work. The head of the machine is fed into the gear under a certain pressure so that if a gear mounted in the machine has an excessive amount of stock, the cutting rack will not break or the machine stall. The head of the machine can be set either right or left to 55 deg. helix angle. The production time for a 25-tooth, 10-pitch gear, with 44 deg., 24 min., 55 sec. helix angle, $\frac{3}{4}$ -in. face, and 0.003 in. to 0.005 in. stock on the tooth thickness, is three per minute.

From the shaving operation gears go to a gear burnishing machine where they are burnished and thence to heat treatment. After being heat treated and hardened they are lapped to remove any distortion caused by the hardening. Lapping machines are of the vertical type. Gears are lapped an average of 50 strokes, kerosene being used as both a coolant and lubricant. Each machine is individually motor-driven and has an exhaust duct above it to remove the abrasive dust and dirt arising from the lapping operation.

To the right of the lapping machine operator is a special washing machine in which gears are cleaned and flushed of all abrasive material after being
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Practical Methods for Heating So

THE most simple and often most useful form of an inductively heated muffle is one in which a short or a long tubular muffle furnace is maintained at a desired temperature by heating the tube inductively with an inductor coil which surrounds it. The tube may have any desired length and be of any cross-section as round, oval, square, rectangular or semi-circular with a flat bottom. The material of the tube may be nickel-chrome, chrome-steel, or even graphite when provision is made to protect this from oxidation. Whatever the material or form of the tube, it should be considered the susceptor on which the inductor acts.

The inductor winding is usually made to conform to the contour of the cross-sectional area of the susceptor. It is good practice to make the coupling between inductor and susceptor between 50 and 60 per cent. The space between the two is filled with any suitable highly heat-insulating refractory.

The material to be heated, such as strip metal, rods or tubes, may be intermittently placed in the muffle until it has reached the desired temperature or the same may be fed steadily through the muffle. All heating of the material results from heat radiated to it from the inside wall of the muffle. It is easy to maintain the heating chamber filled with a protecting gas.

The wall thickness of a tubular muffle would be chosen usually from $\frac{1}{8}$ to $\frac{1}{4}$ in., but it may be much thicker, if desired, without appreciably altering the efficiency of the muffle heater.

A muffle heater of this character, with heavy duty to perform should be generally not less than about 2 in.

in its least outside diameter. The reason for this is that a higher frequency is required to inductively heat a susceptor efficiently which has a small diameter than one of larger diameter. The highest frequency which may be economically supplied with a generator is about 5000 cycles and an inductor type of machine is required for this.

It takes about 5000 cycles to efficiently heat a susceptor as small as 2 in. in diameter. Wire wound alternators are now standardized to give 960 or 1000 cycles. This frequency is quite adequate to heat a 4-in. diameter susceptor but hardly high enough for one only 2 in. in diameter. The efficiency, uniformity of temperature, and the ease of control of temperature of an inductively heated muffle is surprisingly satisfactory.

A manufacturer of razor blades has in service six inductively heated muffle furnaces which are giving entire satisfaction both from the technical and economic viewpoints. Three of these muffle heaters were photographed before shipment and are shown in Fig. 3. One of the heaters appears with one end fitting taken off to reveal the sectional construction of the muffle, and the other heaters are shown partially and entirely complete.

Following is a brief description of the power-generating equipment, the six muffle heaters, and their performance; also of the economies they have effected:

The frequency changer set consists of a General Electric Co. 60-kw., three-phase, 550-volt, 4800-cycle generator, together with control panels, instruments, voltage regulator and exciter. The generator is directly connected to a standard 125-hp., three-phase, 440-volt, 3600-r.p.m. squirrel-cage induction motor.

The overall dimensions of the muffle heaters are 10 in. by 10 in. by $14\frac{1}{2}$ ft. long. The muffle is made of a welded nichrome tube 2 in. in diameter and flattened to an oval shape. Its wall thickness is 0.1 in. and it is also $14\frac{1}{2}$ ft. long.

The entire length of the muffle is covered with heat insulation and inserted in the inductor. At the exit end of the heater, the muffle is held in a fixed position while the other end is free. At the free end provisions have been made to allow for the expansion of the muffle which has been found to be $1\frac{1}{4}$ in.

The inductor consists of a thin wall copper tubing wound the full length of the muffle and is water cooled. Taps are provided in order to control the power input to each heater.

Performance of the Heaters

The heaters operate at a temperature of 812 deg. C. (1500 deg. F.) and it is essential that a uniform temperature be maintained throughout the length of the muffle with the exception of 1 ft. from the exit end. The number of turns per inch are increased at this point to bring the temperature up to 870 deg. C. (1600 deg. F.).

The heaters are electrically connected so that a balanced three-phase load is had when all the furnaces are on. In order to provide a balanced load when one or more furnaces call for a drop in temperature (power off) a dummy load is used. This load consists of a water-cooled resistor and draws about the same amount of power as one heater. There is one dummy load for each heater.

A temperature controller is connected to each heater and these are so arranged as to provide three controls, namely: (1) off (no power), (2) holding power (constant temperature) and (3) raising power (rise in temperature). These controls operate contactors mounted on the

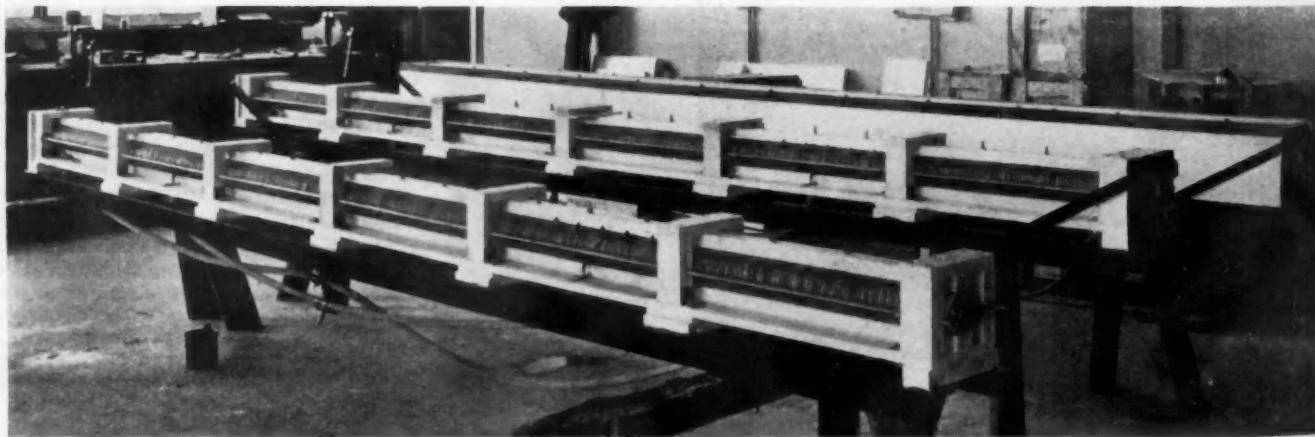


Fig. 3.—Muffle heaters, in use in an American plant, for inductively heating razor blade steel.

ing Solids by Induction

By DR. E. F. NORTHRUP

Vice-President, Ajax Electrothermic Corp.
Trenton, N. J.

THE use of electric inductive heating in the manufacture of razor blade steel and chromium plated tubes is described in the current article, which is the concluding portion of an abstract of a paper presented by the author before the Pittsburgh district section of the Association of Iron and Steel Electrical Engineers. Wide application of inductive heating is envisioned by Doctor Northrup, who states that its use will free metals and alloys from poisoning by deleterious matter and will prevent the formation of hundreds of tons of surface oxides on metals during heating.

switchboard in the generator room and function according to the temperature demands of the muffle.

The thickness of heat insulation on the muffle was so designed as to give a reasonable efficiency and at the same time permit the temperature of the muffle to drop quickly. This feature is highly desirable as it gives a precision control of the temperature. For example, after the working temperature has been reached, it is possible to raise the temperature 25 deg. F. in one minute with the "raising" contactor and also cause a drop of 40 deg. F. per minute on the "off" position. In the general operation of these muffle heaters, a temperature is held throughout the day at 1600 deg. F. with a variation of less than 0.4 per cent of absolute.

Some of the Economies

The six heaters operate continuously with a power input of 62 kw. measured at the motor terminals. The total production of heat-treated strip steel for the six heaters amounts to 92 lb. per hr. giving a power cost of 5 mils per pound at 7.5 mils per kWhr. or \$5 per 1000 lb.

At this point the author fully discusses details of many other applications of inductive heating, some of which are:

Muffles for batch heating, single sheet metal and continuous strip metal heating, radiation inductive sheet heater, "semi-inductive sheet heater," roll heating, heating ferrous metals below decalescent point, and batch sheet heating by semi-direct induction.

There is a section devoted to a discussion of heating magnetic steels inductively.

Direct Induction for Heating Straight Ferrous Tubes and Pipes

THE application of induction to the heating of straight tubes and pipes is very simple and presents no complications, nor requires unusual

equipment provided the tube or pipe has a diameter sufficient for effective heating with the frequency available. For heating tubes three or more inches in diameter, very effective heating can be done with current of the usual frequency used in metal-melting practice. Where motor generator sets are used for this purpose, to supply the high-frequency power, a frequency of about 1000 cycles per second is now very generally recognized as being most satisfactory from both technical and economic considerations. Any problem which involves the heating without melting of symmetrically shaped metals, solid or tubular, which are over three inches along the smallest dimension of a right section, may therefore be handled with what may be termed "standard high-frequency power equipment." Owners of such equipment, and there is now installed about 12,000 kw. in the United States, may have at times an excess needed for their melting requirements. It is well for these to know the uses, other than melting, to which the equipment may be put.

If the tubes are of smaller diameter, down to about 1½ in., a higher frequency than 1000 cycles is indicated. High-frequency generators of the inductor type giving 4800 cycles are now in commercial use and the current supplied by these will heat efficiently tubes, rods, etc., of the smaller diameters.

When a steel tube is chromium-plated, the cohesion and quality of the plating is greatly improved if the tube is heated by induction to 1000 deg. C. or over.

The Heppenstall Co., of Pittsburgh, has been using the inductive method for heating chromium-plated tubes. The writer is greatly indebted to this company for taking and for allowing him to publish the photograph which is reproduced in Fig. 4.

As plainly appears in the illustration, the tube being heated passes through a relatively short inductor coil and is regularly and controllably rotated and advanced at an adjustable speed by the revolving asbestos board disks on which it rests. This

(Concluded on Advertising Page 10)

FIG. 4.—Inductive heating of chromium-plated tubes in use by the Heppenstall Co. at Pittsburgh.



Widening Scope of Aluminum Per

To produce an extremely dense structure in an aluminum alloy casting, the permanent mold process is usually employed. This process consists of pouring molten metal into a hot metal mold or die, but differs from the die casting process in that the metal is fed into a hot mold cavity by gravity rather than into a water-cooled die by pressure. In the best practice, the mold is designed and operated so that solidification takes place progressively; that is, the part of the casting farthest removed from the sprue and risers solidifies first, and it is this progressive feeding of the casting, together with the rapid chill the metal receives on coming in contact with the metallic mold, that makes possible a casting which represents the highest degree of metallurgical perfection in the casting art.

The fine grain structure of a permanent mold casting and the fact that the casting is unusually free from the more common foundry defects, such as dross, air pockets, porosity and the like, insure the maximum physical properties that can be obtained in any type of aluminum alloy casting. Of equal importance, perhaps, is the material reduction in losses in the machine shop and after polishing. This, of course, results from the general soundness of the permanent mold

BRIEFED in this article is the case of the type of casting that lies between the sand casting and the die casting. Applications include those where accurate and extensive machining are necessary, those where lightness and strength count, those where either or both dimensional accuracy and smooth finish are important, and those where intricate shapes are desired, these sometimes involving complicated cores.

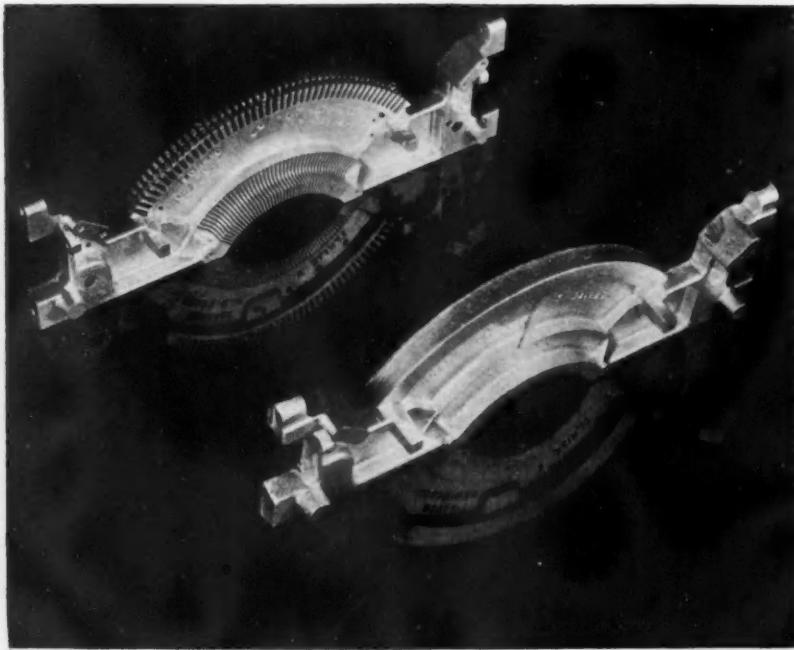
casting. The amount of finish necessary for machining may be reduced below that required for sand castings, and since the surface of the casting is exceptionally smooth, for many purposes finishing operations may be eliminated.

Permanent mold castings are not precision products. Their dimensional accuracy is midway between that of sand castings and that of pressure die castings. In specific cases, however, tolerances on certain important dimensions have been held to 0.005 to 0.010 in.

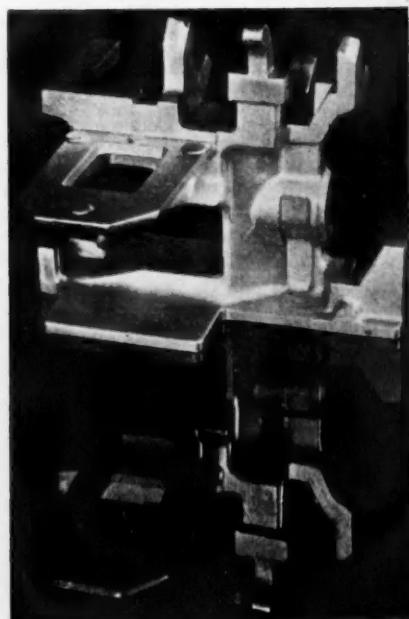
A number of factors are involved in determining the cost of permanent mold castings. The initial cost of the mold, of course, is greater than the initial cost of pattern equipment for many types of sand castings; but, where a large number of castings is involved, the mold cost becomes a practically negligible item. As a rule, the foundry making the castings stands the expense of mold repairs or replacements and the customer has only the cost of the first mold to consider.

Frequently, it is found that the smooth and accurate castings produced in permanent molds eliminate sufficient machining to more than offset the cost of mold equipment, even in the case of very limited production requirements. For example, in castings requiring considerable etching and machining, it is often economical to employ the permanent mold process for a small number of castings because of the saving in machining and finishing cost.

Since the characteristics of the permanent mold process are such that



Typewriter segment as cast in a permanent mold and as machined, illustrating that now such a casting can meet extensive, accurate machining requirements.



Sideframe and base for Teletype machine illustrate that intricate shapes can be produced by the permanent mold process.

a smaller amount of finish is required than for the sand casting process and the tolerances are smaller, less metal is required per piece. This saving in metal cost often proves to be quite an

Aluminum Permanent Mold Castings

By HARRY L. SMITH, JR.
Aluminum Co. of America

important item, as, for example, in the case of a quantity production run on a casting requiring 1.1 lb. of metal when cast in sand and only 1.0 lb. of metal when cast in permanent molds.

A variation in the permanent mold process, commonly called the semi-permanent mold process, is at times employed. In this process, the mold is constructed of metal but one or more cores are of either green or dry sand. In general, the semi-permanent mold process is used to obtain as far as possible the advantages of the permanent mold where the part is too intricate to be produced by the full permanent mold process.

Fields of Application

The physical and chemical properties of a few of the more common permanent mold alloys are given in the table. Some of these alloys depend upon heat treatment for their physical properties, while others are not susceptible to heat treatment. The selection of alloy is governed by a number of different characteristics, such as strength and ductility, hardness, machinability, fluidity, casting properties, corrosion resistance, and/or the ability of the alloy to retain satisfactory properties at elevated temperatures.

Few castings require as much machining as the piston of an internal combustion engine, and the permanent mold process is employed for the production of this part almost to the complete exclusion of all other casting processes. Not only do the soundness of the permanent mold piston and its freedom from foreign ma-

terials insure better machining qualities, but its dense structure imparts to it better heat conductivity and greater hardness than can be obtained in any other type of cast aluminum pistons.

The top plates and lower segments of typewriters also require a large amount of expensive and accurate machining and here, too, is found a definite application for the permanent mold process.

The exceedingly fine grain structure of a permanent mold casting makes it possible to obtain in this type of casting the maximum amount of strength with the minimum amount of weight per piece. This does not mean that permanent mold castings

are stronger on a unit basis than certain wrought aluminum products; yet, when design is taken into consideration, it is possible to produce the permanent mold castings with a smaller amount of metal because of the adaptability of this process to a greater variety of shapes and forms.



The semi-permanent mold process was used for casting vacuum cleaner nozzle and integral fan housing, typifying parts in which a metal core cannot be easily drawn or collapsed.



Bearing cap for airplane motor, which must have maximum strength with a minimum weight, was made by the permanent mold process.

The bearing caps for airplane engines or the brake shoes for automobiles exemplify this use for permanent mold castings exceedingly well.

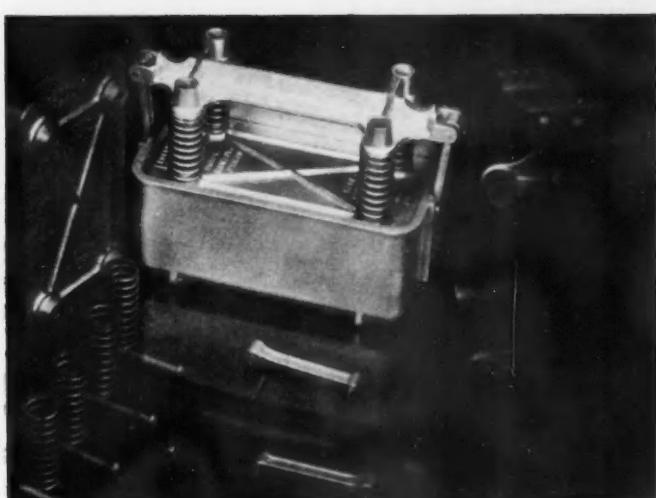
Castings of Intricate Shape

Considerable progress has been made in the casting of intricate shapes, and the designer no longer need feel that the permanent mold process is limited to simple shapes only. Many complex parts, such as the side frame and base for a Teletype machine, have been and are being produced as permanent mold castings through the cooperation of the designer with the foundry. In this respect, a permanent mold casting is not any different than the other types of casting if the user of the casting desires to obtain the optimum in design and foundry technique.

Castings of Cooking Utensils

Two examples may serve to show the ease with which comparatively complicated cooking utensils can be fabricated from permanent mold castings. One of these is a pressure cooker, and the other, a ham press.

The pressure cooker consists of a
(Concluded on Page 340)



Ham press fabricated from aluminum permanent mold castings.

Threading Dies—Their Manufacture and

NICKEL is present to some extent in all high-speed steel. Steel manufacturers make an effort to keep the content as low as possible. The work of Strauss and French showed 3.37 per cent nickel in high-speed steel to have little influence on the cutting efficiency of lathe tools. Others have observed that nickel over 0.50 per cent reduces the cutting efficiency of milling cutters. As a consequence some specifications arbitrarily place the maximum allowable limit at 0.25 per cent nickel. However, many specifications today call for nickel under 0.15 per cent, since practically all manufacturers of high-speed steel can meet this requirement.

Our own specification calls for nickel under 0.10 per cent as we believe small amounts of nickel detrimental to chasing tools. We have found that nickel causes high-speed steel threading tools to decarburize during heat treatment. A search of the literature shows no data on the decarburizing effect of nickel on high-speed steel. The following is offered as evidence that nickel does exert a decarburizing effect on high-speed steel tools. As the tendency in high-speed steel manufacture is toward higher amounts of nickel as accidental impurity, it is felt this property of nickel is worthy of note.

About three years ago we encountered a heat of high-speed steel which gave us considerable trouble. Chasers made from this steel proved very soft to a file on the tops of threads as hardened and after drawing. At first cobalt was suspected as the offending agent. A qualitative test showed the absence of cobalt. A test for nickel revealed considerable present and a quantitative analysis showed 0.81 per cent nickel and 0.20

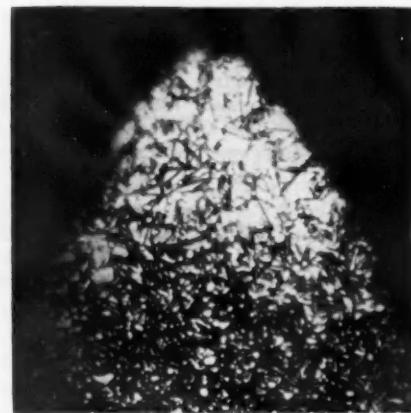


FIG. 1.—Photomicrograph of 28-pitch thread, etched in 5 per cent nital. Reduced one-half from 1000 diameters.

per cent copper. The matter was taken up with the steel mill which later found that the nickel had been introduced through the high-speed steel scrap used. The scrap had contained some Monel metal. The ordinary spark testing of the scrap did not reveal the difference between Monel metal and high-speed steel, since both produced a red spark when tested by means of a grinding wheel. It had been the practice of the steel mill to analyze every fifth heat for nickel.

Since little nickel is lost through oxidation in steel making, it was felt that the return high-speed mill scrap, if high in nickel, would show enough increase by every fifth heat to give adequate indication of contamination. In spite of this the defective heat passed unnoticed. Even Brinell tests on the annealed bars did not show enough difference to permit of separa-

tion. There was no noticeable difference in machineability during the thread milling, an operation which quickly shows differences in the machineability of high-speed steels.

Nickel and Decarburization

As a result of our experience with the heat containing 0.81 per cent nickel, the following investigation was made to determine quantitatively the decarburizing effect, if any, of nickel, on high-speed steel chasing tools. Three small heats of high-speed steel containing 0.31, 0.55 and 0.75 per cent nickel rolled to $\frac{3}{8}$ in. by 1-1/16 in. were secured through the cooperation of the steel mill. A similar size of our regular steel with 0.70 per cent carbon and a special steel of 0.75 per cent carbon were also included. The analyses of the steels used in this investigation are given in Table I.

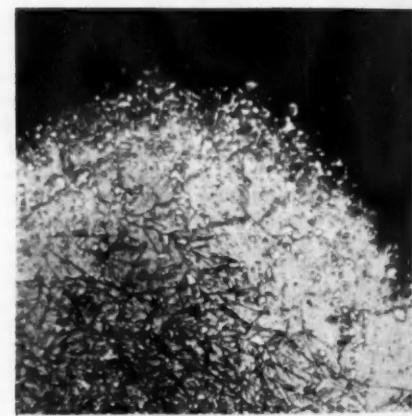


FIG. 2.—Photomicrograph of 14-pitch thread, etched in 5 per cent nital for 2 min. Reduced one-half from 500 diameters.

The nickel heats are comparable except that the vanadium is about 0.20 per cent higher. However, we do not believe this would influence appreciably the results obtained.

Annealed samples were measured for decarburization with the following results:

DZ	0.010 in.
ES	0.012 in.
60	0.015 in.
61	0.018 in.
62	0.022 in.

The bars were cut to $2\frac{1}{8}$ in. lengths. A minimum of 0.053 in. up to 0.063 in. was milled off one of the wide sides and from each of the thin sides. Sixteen pitch threads were then milled on the wide side from which the 0.053 in. to 0.063 in. had been milled off.

Samples containing 0.31, 0.55 and 0.76 per cent nickel and samples of

TABLE I—ANALYSIS OF STEELS USED

Symbol	Heat Analysis					Bar Check			
	C	W	Cr	V	Ni	C	Ni	Co	Cu
DZ	0.70	18.16	3.87	1.00	0.08	0.69 to 0.70	0.08	Trace	.....
ES	0.75	17.84	3.98	0.98	0.08	0.74 to 0.74	0.08	Trace	.....
60	0.69 to 0.70	18.12	4.06	1.24	0.31	0.70	0.31	Trace	Trace
61	0.75 to 0.76	18.16	4.09	1.20	0.51	0.75	{ 0.55 }	Trace	Trace
62	0.74 to 0.75	17.88	4.12	1.16	0.75	0.75	0.76	Trace	Trace

TABLE II—FILE TEST OF TEETH*

Samples	Oil Quenched		Air Quenched	
	As Quenched	Drawn 1050 Deg. F. 1 Hr.	As Quenched	Drawn 1050 Deg. F. 1 Hr.
DZ	Hard	Hard	Hard	Hard
ES	Hard	Hard	Hard	Hard
60	Hard	Hard	Hard	Hard
61	{ 5 Hard }	Soft	Fair	Soft
62	{ 7 Fair }	Very soft	Soft	Very soft

*Result of testing 4 to 12 samples of each lot.

ure and Cutting Efficiency

By J. G. MORRISON
Metallurgist, Landis Machine Co.
Waynesboro, Pa.

0.70 and 0.75 per cent carbon were placed alternately, thread side up, on nickel trays. The trays containing the samples were preheated at 1600 deg. F., requiring 14 min. to come to heat. The trays were then transferred to a high heat furnace at 2350 deg. F. Good reducing atmospheres were maintained in both the preheat and high heat furnaces. One lot of samples was quenched in still air and one lot in oil. Table II shows the result of file testing the points of chasers using a No. 2 Nicholson file in both the as-quenched and drawn condition.

All samples were then heated for about 5 min. in a 30 per cent solution of syrupy phosphoric acid which loosened the scale somewhat. The threads were then cleaned free of scale by means of a scribe. The threaded samples were then "annealed" in lead in a small steel pot at 1480 deg. F. holding 20 min. at heat. Check samples of "DZ" steel milled, but not hardened, were "annealed" at the same time. Samples were kept submerged in the lead by means of a steel weight that just cleared the opening. Pots were removed from the furnace, allowed to cool to about 1000 deg. F., and the samples removed and brushed free of lead. Threads were then cleaned with an abrasive eraser and 0.008 in. milled off the tops of threads of each lot. Chips were collected, washed four times with C.P. ether, heated to about 250 deg. F. on a hot plate and placed in a dessicator to cool to room temperature. Chips were sprinkled three times on glazed paper and picked up each time with a pencil magnet. These precautions were taken to remove any contamination of the sample. Chips were then ana-

DECLARING in the first section of this article (THE IRON AGE, Jan. 19) that standard high-speed steel surpasses other materials in meeting the exacting demands on threading dies, the author, in this concluding portion, gives the results of an investigation of the effect of nickel on this grade of steel when used for such dies. He adds some conclusions on the harmful effect due to carburization and on the use of furnaces with regulated atmospheres for heat-treating high-speed steel.

lyzed for carbon with the results shown in Table IV.

The control samples of "DZ" that were thread milled only and given the 1480 deg. F. lead "anneal" were analyzed for carbon on the first 0.008 in. of threads. Analysis showed 0.70-0.70 per cent carbon as compared to 0.69 to 0.70 per cent carbon, the bar analysis.

The steels containing 0.08 per cent nickel show a slight loss in carbon on air quenching of from 1 to 2½ points in carbon. If the threads are sandblast cleaned, due to the slight removal of surface, the loss amounts to ½ to 1 point, an almost negligible amount. When the steel contains 0.31 per cent nickel, the loss of carbon as shown by analyses would be

enough to adversely affect the cutting efficiency. When the nickel is 0.55 per cent and over, threading tools are rendered almost useless, particularly in cutting heat-treated steels.

From the results above it will be seen that nickel in high-speed steel in amounts from 0.08 to 0.75 per cent causes an ascending decarburization in the teeth of threading dies.

It should be noted here that the decarburizing effect of nickel on high-speed steel during heat treatment is almost negligible on blunt surfaces. Nickel appears to cause a harmful decarburization only on surfaces where the proportion of surface area is very great as compared with the mass of metal. This may reconcile some differences of opinion as to the effect of nickel on high-speed steel. Lathe tools present a large mass of metal compared with the surface area and would tend to decarburize very little. In dressing a lathe tool any decarburized skin would very probably be removed. In milling cutters there would be a greater tendency for the teeth to decarburize and the soft skin would not be removed entirely in grinding.

The reason the air quenched samples show so little decarburization is due to the thin scale that is formed during cooling. The scale itself is almost carbon free. Analysis of some samples of scale showed 0.03 to 0.04 per cent carbon. This scale is very adherent down to the point (about 700 deg. F.) where hardening sets in. During the cooling of the tool in air the scale acts as a

(Concluded on Advertising Page 10)

TABLE III—ROCKWELL (C) HARDNESS*

Samples	Oil Quenched			Air Quenched		
	As Quenched	Drawn 1050 Deg. F. 1 Hr.	As Quenched	Drawn 1050 Deg. F. 1 Hr.		
DZ	65.0	64.0	65.0	63.5		
ES	65.5	64.3	65.5	63.75		
60	64.5	63.0	64.0	63.0		
61	64.5	64.5	64.5	63.75		
62	63.75	63.75	63.3	63.2		

*Average of four readings on each of 4 to 12 samples of each lot.

TABLE IV—ANALYSIS OF CHIPS FOR CARBON
Carbon Analysis First 0.008 In. of Teeth

	Carbon Analysis Bar	Nickel Analysis Bar	Air Quenching		Oil Quenching	
			Carbon	Ave. Loss	Carbon	Ave. Loss
DZ	{ 0.69 { 0.70	0.08	{ 0.68 { 0.685	0.015	{ 0.69 { 0.70	0
ES	{ 0.74 { 0.74	0.08	{ 0.72 { 0.715	0.023	{ 0.74 { 0.74	0
60	0.70	0.31	{ 0.63 { 0.64	0.065	0.645	0.055
61	0.75	0.55	{ 0.63 { 0.635	0.12	0.62	0.13
62	0.75	0.76	{ 0.60 { 0.60	0.15	0.60	0.15

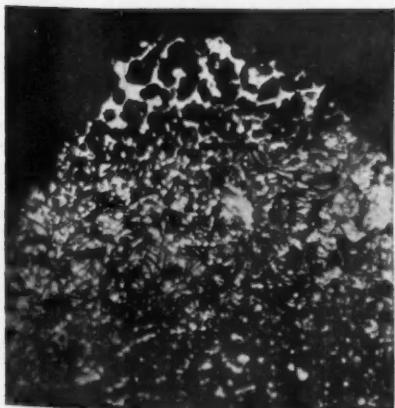


FIG. 3.—Typical structure of a decarburized thread. Reduced one-half from 1000 diameters.

Flash Welding Automobile Doors

THE development of the modern automobile door furnishes an excellent example of the ingenuity, vision and resourcefulness of body and tool designers on the one hand and of steel companies and door manufacturers on the other. Only through close cooperation of these four interests has the present efficient production of a satisfactory steel door been possible. The early wood frame door has practically disappeared and in its place has come an all-steel, rigid,

heavy presses; one row for the outside panel and one row for the inside panel. Fig. 2 shows a view of part of this press equipment. The first press operation consists of blanking the sheets to the approximate shape of the door and piercing various holes in the sheets (called "draw holes") which allow for the proper movement of the metal during the subsequent forming operations. The second press operation roughly forms the window openings and the succeeding operations

transform the sheet into the completed panel. For example, one operation curves the entire lower part of the door so that it will conform to the shape of the body; another presses a reveal around the edge of the window opening and a bead across the door; and still another, known as "trimming," cuts the window openings and door to the desired dimensions.

Some of the dies which perform the different operations on the doors seem to work with human-like intelligence. When both inside and outside panels have been completed, they are carried on overhead conveyors to the first assembly stations, where small parts, such as hinges, sound-deadening devices, etc., are added. From there they are conveyed through further assembly stations where the two panels are joined by folding the edges together in heavy presses and by "spot" welding.

For some designs certain parts are joined together by flash welding and in other cases flash welding is employed to join flat sheets of different shapes and sizes in order to utilize efficiently all the material. As with other methods of welding, the flash welding process has been developed to a high degree of proficiency at the Budd plant. Fig. 3 shows one of the large specially designed flash welders.

The flash welding operation appears to be a very simple operation,

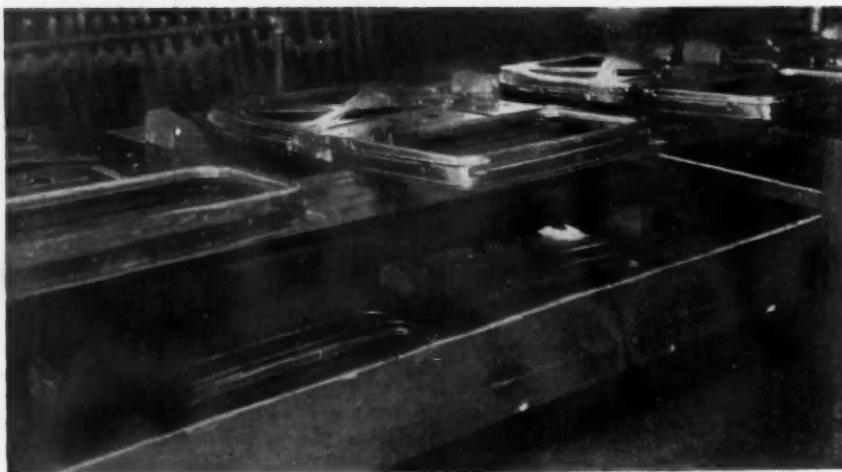


Fig. 1—This shows the all-steel door on the assembly conveyor. Note the economy of space through the use of two conveyors, one above the other.

sound - damped door which is lighter, stronger, more permanent and less expensive.

The Press Work

One of the largest manufacturers of these modern doors is the Edward G. Budd Mfg. Co., Philadelphia. This company has a large building devoted exclusively to the manufacture of this one product, which consists essentially of two stampings, one, an outside panel and the other, an inside panel. The inside panel is usually drawn with a deep flange, the function of which is to make a rigid box-section of the finished door. The two to three-inch space between the inside and outside panels furnishes adequate room for the window glass and lock mechanisms. In addition, stiffeners and sound-deadening devices are usually placed between the stampings. A typical door in the process of manufacture is shown in Fig. 1.

In order to meet the requirements of high production in the Budd door plant, there are two long rows of



Fig. 2—Two rows of large presses extend the length of the building, each row taking care of the manufacturing sequence on one panel.

Steel Doors

but this is only because the many variables have been very carefully studied and are accurately controlled. For example, it is important to know and to control the voltage, the amount of current consumed, the time of application of the current and the distance between the sheets before contact is made.

Briefly, the flash welding operation consists in holding two separated but electrically contacted sheets or stampings accurately in position and then causing their edges to be moved together at a varying rate. The initial position of the sheets is such that there is a slight angle between their lines of approach. As a result of this, contact between the sheets occurs at one end. A current of 1500 amp. and 7 volts is used to cause an arc which passes along the edges of the metal. By carefully controlling the rate of advance of the two sheets, the proper welding temperature is secured. The current is then automatically turned off and the sheets are moved together with a quick positive motion which squeezes out a por-

SOME ten years ago automobile body manufacturers designed a new type of all-steel door, but before low-cost quantity production of this new door could be developed exhaustive experimental work and many conferences between steel companies, power press manufacturers and the manufacturers who were to operate the power presses were necessary. At first several anneals were required in the process but gradually new steels were developed and new types of forming dies were designed until at present the whole complicated forming sequence is accomplished rapidly and efficiently without any annealing. Methods of flash welding and other features in the production of these modern doors at the plant of Edward G. Budd Mfg. Co. in Philadelphia are here described.

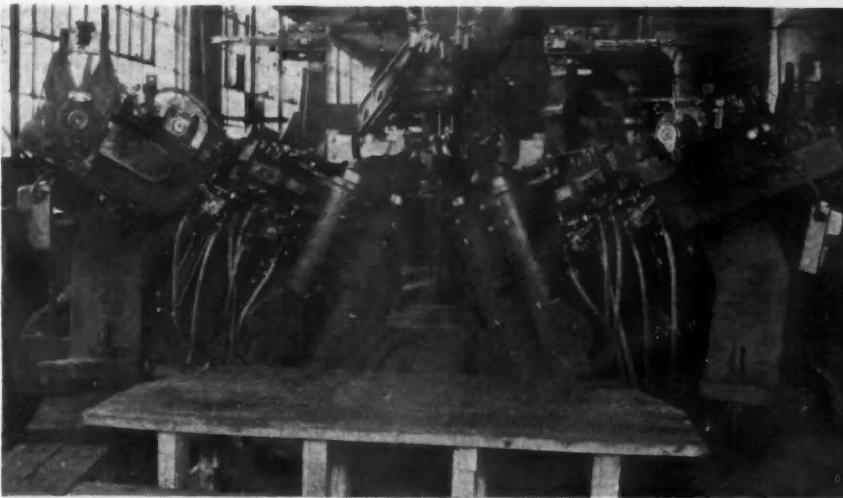


Fig. 3—Highly specialized flash welding machines are used for body and door construction and for joining irregular sheets to reduce the amount of scrap.

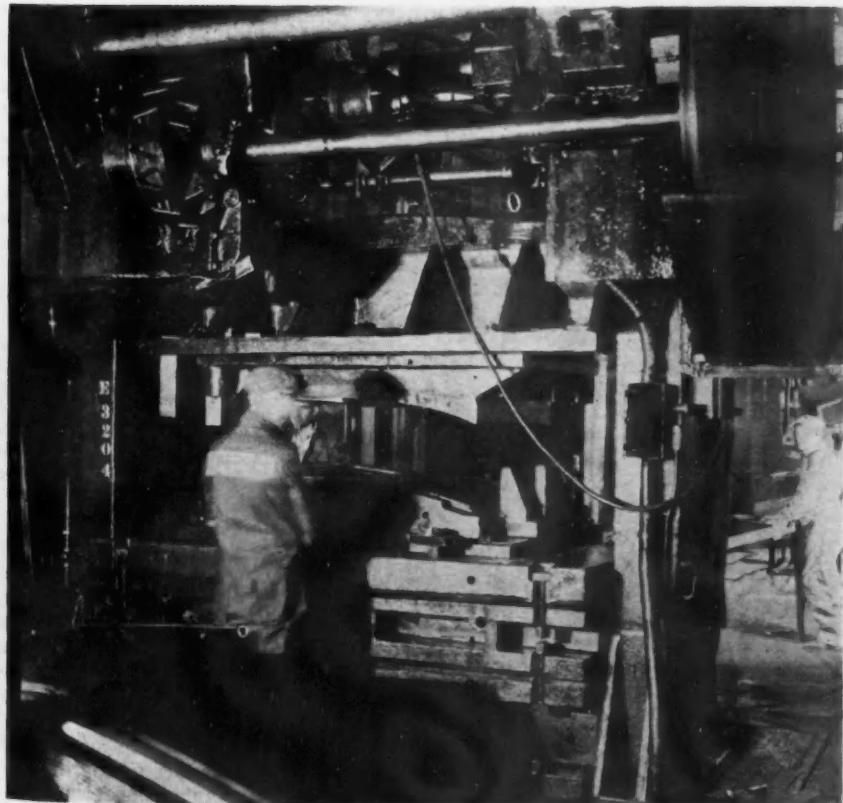


Fig. 4—A close view of the large intricate dies used at one stage in the door production sequence.

tion of the metal together with scale and dirt. Thus a strong ductile weld is made having a fin or "flash" of brittle material on both sides.

In a subsequent operation these fins are machined off or ground away. In some cases, the flash from one side of the sheet only is removed in order to gain added strength and save expense. Experience has shown that with care the flash may be so removed that it is impossible to detect the position of the weld in the completed body. It has also been found that even when the flash from both sides of the sheet has been removed the weld is stronger than the metal making up the main body of the sheet.

William E. Friedman, who was formerly in charge of the New York office of the Hausman & Wimmer Co., has organized A. H. Sanders & Co. with offices at 11 West Forty-second Street, New York, to deal in all grades of iron and steel scrap, specializing in cast iron borings, nickel steel alloys, and useable flues. The company will also buy plants for dismantling. Mr. Friedman has been active in the scrap trade for 25 years. From 1910 to 1925 he was resident New York partner of the E. B. Leaf Co., Philadelphia.

Putting the Question Mark to Work

— 92 —

Selecting a Fuel Oil

What are the essential characteristics of a good fuel oil for use in heating an open-hearth furnace?

D. M.

THESE would vary depending upon whether an acid or a basic furnace were used. If the former, a relatively low sulphur content is essential. The oil should, of course, be free from excessive amounts of sediment, scale and moisture. The viscosity should be low enough to make the fuel adaptable for the system available for handling it. The pour point is of no particular interest if the fuel is to be pre-heated and such is the case in most present-day installations.

Sun Oil Co.

— 93 —

Arbors Prevent Warping

How can we keep ball bearing races from warping during heat treatment?

A. C. M.



WE avoid warping by the use of tapered arbors for quenching. The rings are removed from the furnace with these arbors and allowed to stay on the arbor in the oil quench until cooled.

C. F. S.

— 94 —

Coating for New Galvanized Sheets

Can you refer us to a coating to use on new galvanized sheets before painting?

N. R. L.

WE have a product called Rustarest, which bonds satisfactorily with new galvanized sheets. In addition to furnishing an adhesive bond, it is transparent. It dries quickly, yet maintains an elasticity which prevents cracking due to expansion or contraction. Our tests show that galvanized sheets coated with Rustarest, followed by a coat of paint in the desired color, will stand up against the elements and all sorts of abuse for a considerable time.

Inland Products Co.

Foundry Questions Answered

CAN gray iron be die cast? How are steel barrels painted? Is radium offered free for testing government castings? Is the electric furnace practical for making iron castings? Is beryllium available for the small foundry? These are typical of the many questions about foundry practice which are being received and answered in this department. Often the answer to a simple question means the difference between profit and loss. If you want to know how others may have solved your problem, write about it to the Forum Editor, Iron Age Publishing Co., 239 West 39th St., New York.

▼ ▼ ▼

— 95 —

Who Makes Inhibitors?

Can you give me some information covering inhibitors for muriatic acid?

Irving M. Herrmann.

THE American Chemical Paint Co., Philadelphia, makes an inhibitor known as Rodime Extract. We also understand that Keystone Steel & Wire Co., Peoria, Ill., has produced one or more inhibitors of similar nature.

S. E. Maxon.

— 96 —

Evaluating Patterns

Is it advisable to make an accurate pattern inventory at least once a year and how is the value estimated?

C. L. T.

IN these days of quick changes where machines and parts often go into the discard in a few months, the pattern inventory is not much more than a supply item. It is part of good planning to provide for the pattern costs on some system of scheduling, but as a capital asset we feel that patterns may be largely ruled out of the column.

R. C. Hopkins.

— 97 —

Measuring Metal Pipes

Can you tell me where I can get apparatus for testing the thickness of the walls of metal pipes?

S. I.

I HAVE developed a test which is electro-magnetic in character and which is patented. The equipment for its application must be specially built for the job in question.

Alfred V. de Forest,
Bridgeport, Conn.

Enamel for Galvanized Sheets

Can you tell us of a paint or enamel which could be satisfactorily used on new galvanized sheets?

R. O. M.

THIS is a difficult problem but may be solved by studying conditions at the plant of the manufacturer and if necessary making some alterations in the galvanizing process. In several cases, we have been able to produce a special enamel which has made it possible for the customer to put galvanized sheets through his regular manufacturing process without the usual aging or other surface roughening experiments. Each plant must be studied individually, as the enamel suitable for one might be unsatisfactory for another.

B. V. C.

— 99 —

Fuel Oil and Open Hearth Furnaces

We feel we are using an unusually large quantity of fuel oil in operating a 20-ton open-hearth furnace. Can you give us some idea of an average performance?

C. S. B. M.

THE amount of fuel oil consumption in a 20-ton open-hearth furnace naturally varies with conditions of the furnace design, with the class of metal, temperature of air, method of operation, and the B.t.u. content of the oil. In actual practice, 38 gal. per ton is possible with small furnaces melting foundry steel. Large furnaces may bring the fuel oil consumption down to 25 gal. per ton or even less.

The Alliance Brass & Bronze Co.

— 100 —

Melting Scrap Cast Aluminum

We have had trouble melting up scrap cast aluminum to produce small pulleys and other similar products. At times the metal becomes tough and hard to work and at other times everything is satisfactory. We are using a cast iron pot for melting and another cast iron pot for pouring.

C. T. M.

OUR experience has been that most users of scrap aluminum encounter difficulties as stated, namely, the metal becomes tough and hard to work at times. This is usually due to the presence of excess iron or silicon or both. We believe the best way to overcome the difficulty is to add sufficient new aluminum of a high purity to dilute the iron and other impurities to a point where the metal will become fluid and may be cast easily.

T. D. S.

Bell-Type Retort Furnace Has Wide Heat-Treating Range

TO meet the demand for flexible equipment that may be employed to advantage not only in jobbing shops and tool rooms, but also in large plants operating on reduced schedules, the American Gas Furnace Co., Elizabeth, N. J., has brought out the bell-type retort furnace illustrated. Designated as the "New Universal Heat-Treating Tool," this furnace is adapted for carburizing, nitriding and bright annealing in gaseous atmospheres, and also for hardening, normalizing, annealing and tempering.

Although especially suited for small jobbing shops or tool rooms, where a wide variety of work is handled daily, these furnaces can be used to advantage in manufacturing plants, it is stated, notwithstanding the increase in labor costs as compared with the large continuous-type furnaces usually employed. A battery of them may be installed and various heat-treating operations performed simultaneously. One or more furnaces may be shut down without reducing the operating efficiency of the others.

For small commercial heat-treating shops and tool rooms, small sizes of the furnace, that may be brought up to temperature quickly and the various heat treatments performed with minimum delay, can be supplied. It is necessary to have only two or three spare bells, with bases, to permit carburizing, then hardening followed by tempering. To obtain a full anneal the work may be left in the furnace overnight, after the furnace has been

turned off. This also applies to carburizing, should it be desired to obtain maximum diffusion and gradation of cases to core, but the carburizing gas should be allowed to continue to pass through the retort during the slow cooling period, burning in the furnace and thus retarding the rate of cooling.

When comparatively slow cooling is required, the bell with its base and work may be removed from the furnace and air cooled in a pit or in an insulated shop can. Quenching direct from furnace temperature can be accomplished either by removing the bell and removing individual pieces, all other pieces remaining in the furnace, or, as in the case of ring gears, a special yoke may be used to elevate the base and work slowly so that the individual gears may be withdrawn and quenched in a jig, fixture or quenching machine.

The bells may be of cylindrical, rectangular or other shape best adapted for the particular work. Uniform results are said to be obtained because the retort is entirely inclosed in the furnace. In carburizing the spent gases escape from the bottom of the bell and are consumed in the furnace. Radiation losses are low, because the bell is entirely inclosed.

Extra bells can be supplied so that the furnace can be maintained in production continuously. Automatic temperature control is provided and a flow meter is furnished for checking the flow of gas through the retort.

Two or more flow meters can be supplied, if desired, where two or more gases are to be mixed.

Elliptical Turning Lathe Suitable for Long Parts

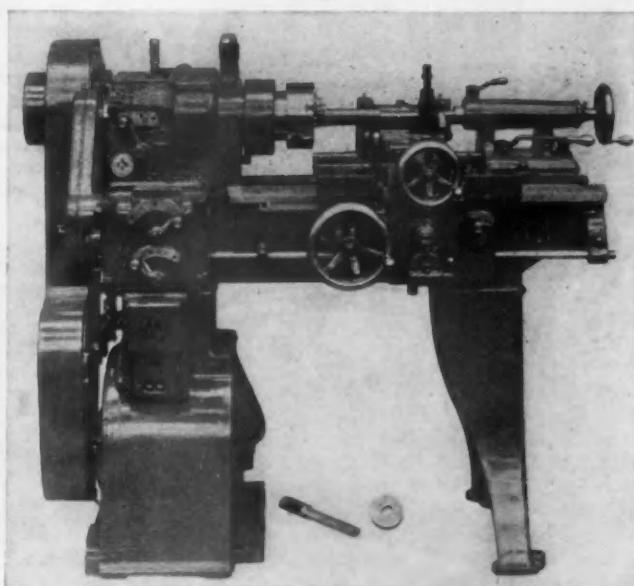
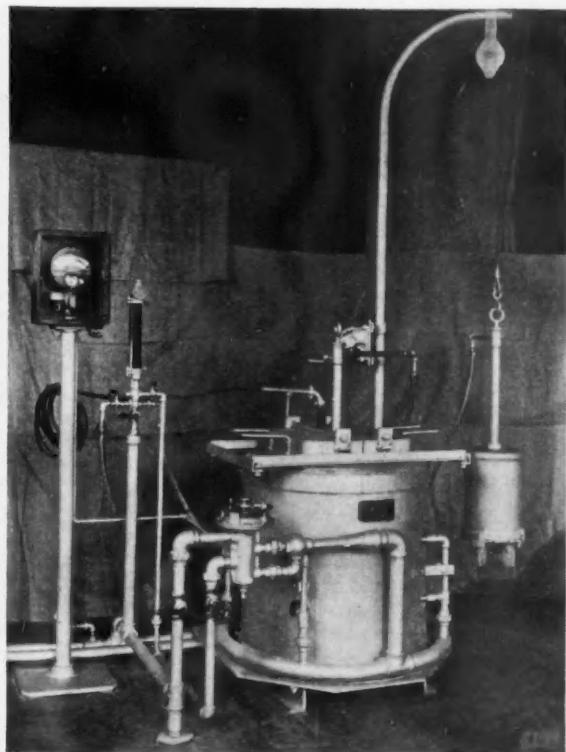
THE R. K. LeBlond Machine Tool Co., Cincinnati, has just brought out a new elliptical turning lathe suitable for turning punches and mandrels or for boring elliptical holes. A standard 11 in. geared-head rapid production lathe was used as a basic machine. A splined shaft is geared to the spindle nose and is supported by the headstock and two brackets on the rear wing of the carriage. The carriage brackets are held rigidly in position and are spaced on opposite sides of the carriage bridge as shown in the illustration. The master cam is mounted between these brackets and is rotated by the splined shaft.

The roller which contacts this cam is mounted in a bracket in the center of the bottom slide. The bracket, cast integral to assure rigidity, is located back of the cam so that the cam will pull the tool into the work. The cam follower is held in contact with the cam by two coil springs.

Since the form of the ellipse is determined by the contour of the master cam, any type of ellipse can be turned or bored merely by changing the cam. Advantages claimed for the machine are rigidity and the wide range of work. The construction permits the turning of long parts, since the length of work that can be machined is dependent only upon the length of the splined shaft and does not necessitate the use of a long master cam.



THE bell-type retort furnace shown at left features flexibility. With spare bells, carburizing may be followed by hardening and the latter by tempering. Punches and mandrels may be turned and elliptical holes bored rapidly on the LeBlond lathe pictured below.



Combination Projection and Spot Welders

NEW large-type of welders developed by the Swift Electric Co., Detroit, include the heavy-duty combination projection and spot welder illustrated. The particular unit shown is the No. 70 CVP, 750-kva. capacity machine equipped with upper and lower tables for projection welding. By substituting upper and lower horns for the tables, the machine becomes a heavy-duty spot welder. Combination welders of similar design can be furnished in all sizes from 50 to 2500 kva.

Mechanical Pressure Adjustable

The frame shown may be equipped with transformers rated from 500 up to 1000 kva., as required. There are two smaller and one larger size of frame than the one shown. Mechanical pressures to consummate the weld may be obtained up to 60,000 lb. by adjustments provided within the welder housing. This great pressure is obtained through a combination of toggle, lever and cam, operated through worm gear reducing unit. Variations in operating cycles per minute is obtained by pick-off gears in the gear train.

The lower table or the horn, as the case may be, is adjustable for various sizes of work and for compensating for die wear. The air cylinder, air tank and air regulator shown on top of the welder is a balancing set which compensates for the weight of the upper head or ram, and permits the

head or ram to move up or down quickly. The motor, gear box, main cam, timing and current cam are inclosed within the main housing and are accessible through doors at the side and rear.

Larger Core-Blowing Machine

FOR blowing cores either in core sand or green sand and in larger and heavier sizes than had been blown heretofore on this type of machine, a new core-blowing machine has been brought out by the Osborn Mfg. Co., Cleveland. This supplements a core-blowing machine of smaller capacity recently brought out by this company.

Sand is Aerated

An outstanding feature of the new machine, designated as the No. 95, is the use of an agitator in the form of rotating paddles within the sand reservoir in the top of the machine. These paddles, set in motion during the blowing operation, thoroughly aerate the sand during the blowing operation and this, it is stated, increases the blowing efficiency and results in more uniform cores with a minimum of core box venting. Another advantage claimed for this agitation is that it prevents the formation of craters within the sand reservoir and permits the blowing of cores of large volume without the presence of pockets or soft spots in the core.

A single operating valve controls all operations of the machine with the exception of the electrically operated

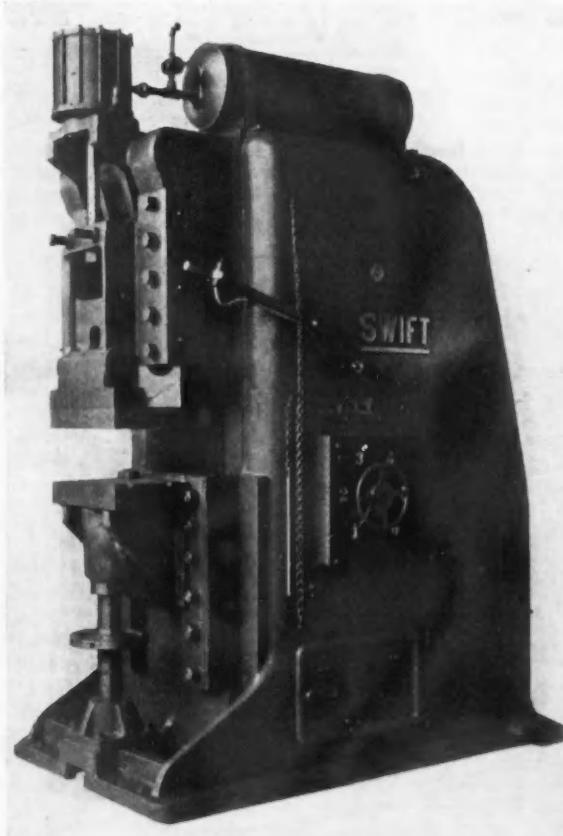
rotating paddle mechanism, which is controlled by push button. The steps in producing the core are: Place core box in machine; start agitator mechanism with push button; turn handle of operating valve; open push button switch, when operating valve handle returns to normal position; and remove core box containing blown cores. The machine is then ready for another core. One blowing operation is said to be sufficient to blow completely any core or mold within the capacity of the machine. The cycle of operations requires between 8 and 10 sec.

Control Automatic

Clamping, blowing and unclamping of the core box or flask are all controlled automatically by the main operating valve. Both vertical and horizontal clamps are of the diaphragm type. The horizontal clamps may be removed quickly to accommodate large horizontally split jobs. Adjustments for core box or flask space may be made quickly with a wrench. A safety device prevents operation when a core box is not in place.

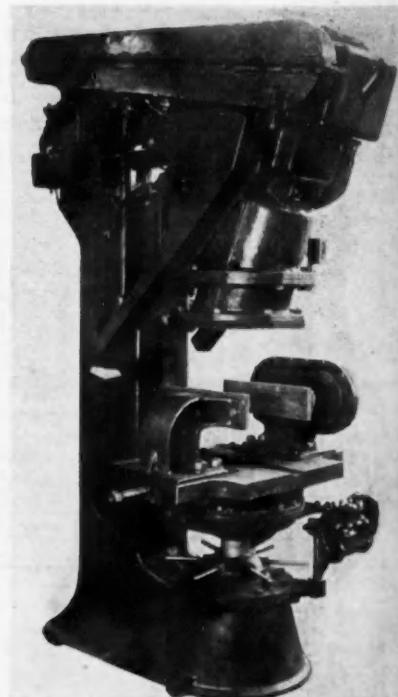
The machine will accommodate a core box 14 to 24 in. high, 6 to 16 in. wide and with a maximum depth front to back of 28 in. The sand hopper has a capacity of 180 lb. of sand and it is stated that the machine will blow a core weighing 130 lb.

One of the illustrations shows an automobile crankcase core blown on the machine. This, made of core sand, is 20½ in. high and weighs 80 lb. The same core has also been blown in green sand.



THE projection welder pictured at left may be changed into a spot welder by substituting upper and lower horns for the table.

LARGE core sand and green sand cores are blown by the equipment at right. The crankcase core below, made of core sand, is 20½ in. high and weighs 80 lb.





Automobile Production Not Hindered By Michigan Bank Holiday

DETROIT, Feb. 20.

ASIDE from the fact that it has temporarily paralyzed retail automobile sales in Michigan, the eight-day bank holiday now prevailing in this State has had slight effect on the motor car industry. Production has gone ahead without interruption, almost all companies having imported money to meet payroll requirements. General Motors has set up disbursing stations in various cities where it conducts manufacturing activities, so that employees can cash its checks, while Chrysler established its own local bank on West Grand Boulevard for the same purpose.

What the industry's showing will be this month and next depends largely on the progress made by the Ford Motor Co. in expanding its output. Ford's program, in turn, hinges on its body supply, which is not large at the moment. It is understood that Briggs and Murray together are shipping 600 to 700 bodies daily to Ford plants. This is far short of the goal of 1200 cars a day at which Ford is aiming. Last week the staffs of some Ford departments at Rouge were still of skeleton proportions. There is no indication that volume production will be attained prior to March 1, if then. On the other hand, it is evident that Ford is desirous of stocking dealers with the new V-eight as rapidly as possible in order to put them in a strong competitive position. These requirements alone will take at least 50,000 cars.

Ford Buys More Steel

In the past week Ford has bought steel for about 20,000 jobs. It is estimated that to date it has purchased steel covering the first 50,000 of its model 40 cars. Nothing has occurred to change the belief that the small Ford will not be out until about May 1. Ford is now asking for prices on a number of parts for this car and may award contracts in the next 30 days. Murray has made some experimental bodies and frames, but it is reported that Ford has not yet decided whether to make frames for

model 44 at Rouge or to let the work to an outside company. Odds favor the latter course, with Murray getting the business. It is said that model 44 is being designed purposely to permit more parts than ever before to be manufactured outside and shipped to branch assembly plants. Incidentally, engineering changes are still being made in the small car. This probably will continue for some time, as is the Ford habit.

Rustless steel will be discarded in favor of enameled steel for the lamp shell of the small car. The rim, however, will still be of rustless material. Lamps will be built at Ford's Flat Rock, Mich., plant, whereas those for the present larger car are being manufactured by a Cincinnati lamp concern. It is understood that the hot-rolled pickled sheets which Ford is using for body and fender stock are proving satisfactory. Since this grade is given a cold pass at the mill, it does not require quite so much finishing work as one might first suspect. Although its price enables Ford to make a considerable saving as against full-finished sheets, this economy is partially offset by the additional finishing operations which are necessary. Some steel men are outspoken in their belief that Ford's prime motive in going over to hot-rolled pickled sheets was to force down the price of full-finished sheets. Whether this is true or not probably will never be revealed, but it is certain that Ford's sudden abandonment of long-established practice by reverting to the use of hot-rolled pickled sheets instead of full-finished sheets contributed materially to the breakdown of the sheet price structure in recent weeks.

Chevrolet Still in Lead

Chevrolet's leadership in sales and production continues unchallenged. In the first 10 days of February Chevrolet dealers delivered 10,544 units, compared with 9650 in the same period of 1932. This brings total deliveries in the first six weeks of this year to 50,245 cars. Last February dealers delivered 32,000 cars to consumers. With a normal increase in

sales the remainder of this month, the total should be considerably ahead of last year. The Flint assembly plant has been operating irregularly this week owing to difficulty in clearing cars for shipment to dealers, since banks were closed and sight drafts not honored. However, suppliers still are shipping in materials. All manufacturing plants are running six days a week. Total assemblies this month still are estimated at 55,000, with no change in the schedule of 72,000 cars for March. Pontiac is holding up well with 12,000 cars coming off the line this month and a like number planned for next month. Buick is moving along slowly. It bought enough steel earlier in the year to take care of its needs during the remainder of the first quarter. Dodge production and sales are being well sustained, but Plymouth operations have slipped to lower levels. Willys-Overland is reported to have suspended all production on its Willys cars this week following its receivership action, but will continue to turn out the commercial units which it is making on contract for International Harvester Co.

The Hudson strike completely collapsed the past week and production is getting under way as rapidly as possible, so that orders received during the shutdown can be filled immediately. Hudson has given some small releases to parts makers. The group of pickets at Briggs' Mack Avenue plant has dwindled to a mere handful. Operations are gradually increasing and are expected to reach a normal level in a few weeks.

Detroit Notes

The Proctor-Keefe Co., Detroit, has built an ice cream truck on a standard two-ton Dodge truck chassis. By the use of Dowmetal, body weight has been reduced to 2000 lb. The pay load with conventional body construction would require a body weighing 4700 lb. and hence a 3 to 3½-ton chassis. . . Through the use of an acoustimeter Packard engineers are enabled to locate points from which noises arise and measure the volume.

Myron C. Taylor Appears Before Senate Committee on Depression

Says Federal Government Should Put Its Own House in Order—Declares Industrialists Are Ready to Help

WAshington, Feb. 21—"The industrialists are a hopeful people," Myron C. Taylor, chairman of the board of directors of the United States Steel Corp., told the Senate Committee on Finance last Wednesday. "They believe in the future of the country and its inherent strength. They are going to use every ounce of energy to pull the country out of the situation."

Mr. Taylor appeared as one of some 250 witnesses who volunteered to offer suggestions for a way out of the depression. Industrialists, financiers, economists, labor and agricultural interests and many others, representing a complete cross-section of American life, are included in the long array of those invited to present their views. Suggestions offered vary widely and present as many confusions as are seen within Congress itself. The hearings promise to carry well through March. When completed, the printed record will be laid before President-elect Roosevelt to assist him in mapping out an economic recovery program. Numerous witnesses, including Mr. Taylor, in addition to testifying at open hearings also submitted confidential statements to the committee.

Federal Government Should Put Its Own House in Order

When asked for his suggestion to lift the depression, Mr. Taylor said:

"The Federal Government should put its own house in order, balance the budget and live within its income, not only to facilitate recovery in the country but also to set an example to other nations to balance their budgets."

Mr. Taylor said that industry learned a lesson from the war, and in 1922-1929 had corrected its capital structure and conserved its quick assets. The reaction in 1929, he declared, was slow in gaining momentum in industry, and it was not until well in 1930, it was stated, that its full effect was felt. Industry was said to have come into the depression well fortified to withstand a considerable siege.

"We have retreated from one position to another involving the price of commodities, the cost of production, the distribution of resources to stockholders and the readjustment of wages only as conditions forced that readjustment," said Mr. Taylor. "We are undertaking to hold that position."

Over-production does not decrease the effort in agriculture as in indus-

try, he declared. Agriculture was said not to take seriously enough the problem which faces it, and looks more to relief through funds to purchase goods at higher prices, though over-produced, than to limitation of production.

Senator King, Democrat, of Utah, asked Mr. Taylor for a suggestion to guide Congress in determining a national policy to "help us out of this depression."

Present Uncertainty Declared To Be Important Factor in Situation

"I believe the present uncertainty is playing a great factor in the revival of our affairs," Mr. Taylor replied. "I believe if the Government will put its own house in order and live within its own income it will go a long way toward restoring confidence."

Mr. Taylor also pointed out that surpluses of raw materials are a great menace, and added that fear of tampering with the money system has meant a great deal of uncertainty in the public mind.

Senator LaFollette, Progressive Republican, of Wisconsin, wanted to know how the budget can be balanced when "we are on a slide," and inquired as to whether it was not necessary to get to the bottom before it is possible to make estimates for balancing the budget.

Mr. Taylor suggested application of simple rules of "our own lives when our resources begin to shrink and we live more frugally and bring our finances into a state of balance."

The Wisconsin Senator said people have been misled as to when the "bottom had been reached," and declared the country is still sliding. He pointed out that commodity prices continue to go down, and inquired if this very fact did not cause hesitation in purchasing, and if it is not true that purchases are made more freely on a rising, rather than on a declining, market. Mr. Taylor agreed with this view.

Senator LaFollette admitted that he had become skeptical over the situation.

"I do not think you should show a lack of faith," replied Mr. Taylor. "We are trying to find a remedy."

Senator LaFollette inquired of Mr. Taylor as to his view of cutting costs to a price level, except that of agricultural prices. Mr. Taylor said he had proposed a slow but not a radical readjustment.

Different Senators pointed out that it was difficult to balance a budget when demands continued to come from business itself for additional funds from the Reconstruction Finance Corporation and other Government organizations set up to aid industry and agriculture. Senator Reed, Republican, of Pennsylvania, said he voted for the Finance Corporation but regretted that he had done so.

Mr. Taylor said he had given much thought to finding a way by which commodities could have some relation to purchasing power, and concluded that the law of supply and demand ultimately determined the question.

Senator Couzens, Republican, of Michigan, inquired if something was not wrong with a system which permitted such a wide range in the purchasing power of the dollar, but Mr. Taylor said he did not know the remedy.

Steel Prices at 136 Compared With 1914 Prices at 100

Prices of steel products, he said, when compared with 1914, stand at 136, and are lower than those for any other commodities, except agriculture. Asked by Senator Couzens about the price of rails, Mr. Taylor said it is \$40 a ton, the same as in 1922. Senator Couzens said the railroads had complained about the rail price, but Mr. Taylor said that the carriers are not buying rails. Prices of rails, Mr. Taylor said, are based on wages, which were said to stand at 156 when compared with 1914. He stated that the price of necessities of life for the average man has gone down more than wages. He said, however, as pointed out by Senator LaFollette, the rate does not indicate the amount of pay to the worker. Industry, he said, had turned generally to relief to remedy the situation. Last year, Mr. Taylor told the committee, the United States Steel Corp. spent \$16,000,000 in welfare work, and expended between \$5,000,000 and \$6,000,000 in direct relief for needy workers.

River Movement of Steel Declined in January

Shipments of iron and steel products on the Ohio River in the Pittsburgh district during January amounted to 18,002 net tons, according to the United States Engineer office, Pittsburgh. This compares with 30,048 tons in the preceding month, and with 45,199 tons in January, 1932. Monongahela River commerce in steel products declined to 11,734 tons in January, compared with 28,169 tons in December, and with 25,327 tons in the corresponding 1932 month. On the Allegheny River, January iron and steel movement amounted to 1627 tons, compared with 7200 tons in December. There was no movement in January, 1932.

... PERSONALS ...

PHILIP M. GUBA, who has been assistant manager of sales in the New York office of the Republic Steel Corpn. since that company was formed by merger early in 1930, has resigned to become assistant manager of sales in the Detroit office

of the Carnegie Steel Co., effective March 1. Mr. Guba was in the general sales office of the Jones & Laughlin Steel Corpn. in Pittsburgh from 1911 to 1918, but left in the latter year to become New York district sales manager of the Donner Steel Co. of Buffalo, where he remained until 1930, having been during a part of that time in charge of Donner sales in the New England and Philadelphia territories as well as New York. With the purchase of the Donner Steel Co. by the interests who formed the Republic Steel Corpn., Mr. Guba joined the New York sales organization of that company as assistant sales manager.

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EDWARD L. RYERSON, JR., president, Joseph T. Ryerson & Son, has announced his resignation as chairman of the Illinois Emergency Relief Commission, effective March 1.

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GEORGE L. L. DAVIS, who was connected with the Scullin Steel Co., St. Louis, from 1904 to 1927, has returned to that company as vice-president in charge of sales. CHARLES L. GILBERT has been elected vice-president and treasurer, to fill the vacancy caused by the death of V. C. Turner, and EDWARD F. JUDGE has been elected assistant treasurer, in addition to his duties as secretary of the company.

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O. L. HOLLISTER was reelected president-treasurer, Federal Malleable Co., West Allis, Milwaukee, at the annual meeting Feb. 14. WILLIAM A. DRAVES was elected vice-president to succeed C. R. MESSINGER, and WILLIAM J. MACNEILL, secretary to succeed L. S. PEREGOY. ALBERT W. DRAVES and LINUS KREBS were elected directors, and Mr. Messinger, Mr. Peregoy, E. L. Wood and WILLIAM C. FRYE were reelected to the board.

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O. B. J. FRASER, formerly in charge of the research laboratory at Bayonne, N. J., of the International Nickel Co., Inc., has been placed in charge of developments in the uses of nickel and nickel alloys in the oil, gas and coke industries and in the industrial uses of non-metallic compounds of nickel. His headquarters



PHILIP M. GUBA

will be at the company's office in New York. NORMAN B. PILLING, formerly in charge of metallurgical research, succeeds Mr. Fraser at the Bayonne research laboratory, with E. M. WISE as his assistant.

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F. C. EIBELL, who for the past four years has been manager of the advertising and publicity department of the Worthington Pump & Machinery Corpn., New York, has resigned. No announcement has been made concerning his plans.

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H. M. GASSMAN, for many years sales representative in the Alabama territory for the Coppus Engineering Corp., Worcester, Mass., has added that company's air filters for industrial and ventilating purposes to his line.

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J. W. WILSON, for the past 20 years designer and engineer of coal preparation machinery for the Link-Belt Co., Chicago, has become identified in

a similar capacity with the Chicago office of the McNally-Pittsburg Mfg. Corp., Pittsburg, Kan.

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JOHN C. REESE has been appointed purchasing agent of Continental Motors Corpn., Detroit, and its subsidiaries. He has recently been purchasing agent for the automobile division of the corporation and formerly was with the Durant Motor Corp. in a similar capacity.

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GEORGE E. WINTERS has been made traffic manager of Continental Motors Corpn. and its subsidiaries. Heretofore he has had charge of traffic only for the corporation. He has been affiliated with Continental for the past 12 years.

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FLOYD O. TANNER, vice-president and general plant manager for the Pontiac Motor Co., Pontiac, Mich., division of General Motors Corpn., has been named director of manufacturing for Chevrolet and Pontiac with offices in Detroit. P. H. MACGREGOR, formerly general superintendent of Chevrolet Motor Co. at Flint, succeeds Mr. Tanner at Pontiac. Recently he has been general superintendent of the Pontiac company under Mr. Tanner.

OBITUARY

JAMES H. JOWETT, executive vice-president of the Ingersoll-Rand Co., New York, died in New York on Feb. 16 after a long illness. He was born in Cleveland 58 years ago and received his schooling in that city. After his graduation from the Manual Training School of Cleveland, he learned the machinist's trade at the Cleveland-Shipbuilding Co. From 1894 to 1897 he worked as a draftsman with the Steel Motor Co., Johnstown, Pa., and with the McMyler Mfg. Co., Cleveland. He became identified with the Ingersoll-Sergeant Drill Co. in 1897, as a draftsman and later became salesman and, in 1905, general sales manager of the Ingersoll-Rand Co. Mr. Jowett was subsequently made executive vice-president of the company and its subsidiaries, and also of the A. S. Cameron Steam Pump Works.

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ALBERT A. WEISS, Pittsburgh district sales manager for the Harbison-Walker Refractories Co., Pittsburgh, died at his home in that city on Feb. 16, aged 43 years. He had been identified with the company for 25 years, and had held his recent position since 1928.

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CHARLES A. YOUNG, president, Young Brothers Co., Detroit, manufacturer of industrial ovens, died on Feb. 17 after a three weeks' illness.

Born in Windsor, Ont., he came to Detroit when he was 24 years old as superintendent of the Detroit Sheet Metal & Brass Co., retaining this position until 1896 when he resigned to go into business which he headed with his brother, George A. Young. He was 74 years old.

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WILLARD R. CARROLL, rolling mill engineer of the Farrel-Birmingham Co., Inc., Ansonia, Conn., died at his home in New Haven on Feb. 3, aged 61 years. Prior to his connection with the Farrel company in 1925, he had been engaged in consulting engineering work and at various times had been identified as engineer, superintendent and works manager in non-ferrous metals works. Mr. Carroll was a graduate of the Sheffield Scientific School of Yale University.

Magnetic impurities in asbestos, mica, glass, sands and other similar materials are easily detected and their extent measured by means of a new magnetic device announced by the General Electric Co., Schenectady, N. Y. In its application to asbestos the device tests specimens containing up to 5 per cent of magnetic ferric oxide impurities. It operates on 110-volt, 60-cycle circuits and can be used by workmen unskilled in electrical measurements.

Projected Detroit Steel Plant To Use New Centrifugal Process

A NEW steel plant to make billets and bars by a centrifugal casting process, with electric furnaces to be used for melting, may be established soon in the Detroit area by Naugle & Townsend, Inc., First National Bank Building, Canton, Ohio. In reply to an inquiry from THE IRON AGE regarding their plans, Naugle & Townsend telegraphed that no detailed information can be given at this time.

It is understood, however, that the company has been financed with about \$1,500,000 capital and has secured a plant in Detroit in which to start operations within the near future. It was originally planned, it is said, to establish the plant at Lansing, Mich., but decision was finally reached in favor of Detroit because of nearness to large consuming markets and an abundance of steel scrap, which will be used exclusively as raw material.

H. M. Naugle and A. J. Townsend, comprising the firm of Naugle & Townsend, Inc., were respectively president and vice-president and general manager of the Columbia Steel Co. of Elyria, Ohio, and Butler, Pa., which engaged some years ago in the development of a process for the con-

tinuous rolling of steel sheets. The company was sold in 1927 to the American Rolling Mill Co., Middletown, Ohio, which had been conducting experiments in continuous sheet rolling at the same time.

The process that, according to reports in the steel trade, is to be utilized by Naugle & Townsend involves the casting of molten metal into a revolving receptacle so that by centrifugal action the metal is cast in the form of billets or bars, thereby eliminating the blooming mill.

Leon Cammen, New York, who is now associated with the American Society of Mechanical Engineers, invented a centrifugal process of casting steel some years ago, but it is understood that the method to be utilized by Naugle & Townsend, Inc., is not the Cammen process, but one that has been worked out along somewhat different lines. The Cammen process has been experimented with for some years. During the past year or two experiments have been conducted quite successfully at the Massillon, Ohio, plant of the Republic Steel Corp. and at the Niagara Falls, Ont., plant of the Electrometallurgical Corp.

Stainless Steel Meeting in Philadelphia Feb. 23

Stainless steel will be discussed in Philadelphia Thursday evening, Feb. 23, at a meeting sponsored by the Philadelphia chapters of the American Institute of Architects and American Society for Steel Treating, and the Philadelphia sections of the American Society of Mechanical Engineers and American Welding Society.

With N. L. Mochel, chairman of the Philadelphia chapter of the American Society for Steel Treating, presiding, the meeting, to be held in the Crystal room, Elks Hotel, Broad and Wood Streets, will be addressed by Dr. Marcus A. Grossman, research engineer for the Illinois Steel Co., and D. T. Haddock, consulting engineer for the American Sheet & Tin Plate Co. Dr. Grossman will speak on "Development of Stainless Steels and the Present State of the Art," and Mr. Haddock will discuss "Stainless Steel, Available Types, Uses and Applications." Fred T. Llewellyn, chairman of the welding committee, United States Steel Corp., and past president of the American Welding Society, will be present to participate in any discussion that may arise concerning various methods of welding the chromium and chromium-nickel alloys. Particular emphasis will be given to the architectural use of stain-

less steels as viewed under the light of contemporary manufacturing, construction and research experience.

A special feature of the meeting will be an exhibit of stainless steel products to be presented in classified displays. The purpose of the exhibit, made possible by producers and fabricators, is to provide an opportunity to observe and inspect the range of application and methods of processing, construction and joinery of these materials and their embellishment.

Advocates Regulation of Competition

The amendment of the Federal Trade Commission Act to establish the trade practice conference as a vital business agency was advocated as the most rational means of eliminating destructive price competition by Nelson B. Gaskill, former chairman of the Federal Trade Commission, before a meeting of the Conference of Statisticians in Industry, operating under the auspices of the National Industrial Conference Board, New York.

Proposing the substitution of the doctrine of regulated competition for the present tradition of free competition, Mr. Gaskill pointed out that the alternative to regulation within limits prescribed by business and enforced

by a national agency may very likely be a state of Communism.

"The keynote of this control is the requirement that the individual selling price shall, with some necessary exceptions, not be less than the individual cost. The governing principle of this regulated competition is that the return of cost in the use of capital is to be primarily assured as the guarantee of public welfare. With this principle, most of our present theories as to 'restraint of trade' are irreconcilable."

To attain these ends, Mr. Gaskill recommended that legislation be enacted to cover the following essentials: It should give the trade practice conference a legal status as a method of originating regulation of competition; it should state, generally at least, the authorized scope of these regulations. Upon the principle stated, there are only two kinds of agreements that industry should not be permitted to make. These are agreements that are monopolistic and agreements that set up uniform selling prices instead of retaining competitive prices based on cost.

The legislation should establish the application of the democratic principle of majority rule in the adoption of regulations. It should provide for supervision by the commission with power to reject resolutions that are monopolistic or fix uniform prices. It should provide for the enforcement of all such resolutions as are not rejected by the commission, by making violations of them unlawful as unfair methods of competition, and finally, it should eliminate or delimit judicial discretion in review, so far as possible.

Coal Interests Oppose Freight Surcharge

WASHINGTON, Feb. 21.—Coal interests presented the principle arguments to the Interstate Commerce Commission against continuance of freight rate surcharges. Particular opposition was made against the double surcharge on the Lake cargo coal movement, one charge for rail shipment to Lake Erie ports and another for shipment to the interior from upper lake docks. The surcharge on coal is 6c. per net ton. One of the arguments against the double surcharge was that only a single charge of the kind rests against the rail-lake-rail movement of iron ore from Lake Superior mines.

Speaking through Alfred P. Thom, general counsel for the Association of Railway Executives, the railroads strongly urged continuance of the surcharges beyond March 31. Mr. Thom insisted the surcharges are necessary to the railroads which are already suffering severely from depleted earnings.

• • EDITORIAL COMMENT • •

Today's Dreams Tomorrow's Realities

ON other pages there appears the last instalment of a description of an application of electricity which the author believes has a promising future—heating metals by induction. Like many other innovations in the past, this one may be skeptically received by the layman. Certainly, however, if the author's predictions are ultimately realized, the results will be a boon to the steel and other metal industries. The ability to bring steel to a heat-treating or forging temperature with great speed and with no loss from scale—this alone is of great industrial importance. Not many years ago the proposal to melt steel commercially in high-frequency electric furnaces was declared impossible. Today such furnaces are in use in the United States and Europe. Less than 30 years ago when the commercial use of electric arc furnaces for producing quality steels was seriously proposed, this, too, was frowned upon. Today electric arc furnace steel leads as a quality steel, largely displacing the crucible product. The dreams of today are often the realities of tomorrow.

Steel Replacement

WHAT are the minimum requirements of steel? It used to be said, in times of light demand, that mere wear and tear needs would absorb 50 per cent of capacity. On that score production long below the 50 per cent rate was taken to mean a piling up of unsatisfied wants, so that sooner or later the pressure would bring an upturn in activity.

One way commonly followed to give the alleged deficiencies quantitative value was to attempt to establish the trend of consumption and then to calculate the difference between the actual and the theoretical consumption. One difficulty has lain in determining the trend itself, even on the assumption that no revolutionary change has occurred in consumers' habits. One may study only casually the curves of production of steel and pig iron in *THE IRON AGE* of Jan. 5, however, to note that a decided sidewise movement has taken place over the last fourteen years and that the current trend of consumption is substantially indeterminate.

Whatever the condition or conditions that specifically intervened to stop for so long the hitherto steady expansion of steel and iron, it remains that ever since the commercial development of the Bessemer process, growth has been steadily upward until 1918. This is particularly so in the case of steel, for the halts of other hard times were brief and are barely discernible in the long record. The increase year by year brought consumption by 1918 up to a rate of 40,000,000 gross tons of ingots and castings per annum but in the fourteen years since then output has fluctuated up and down, with a downward trend, if any, for the period, and an average production for the fourteen years of 38,700,000 tons.

In 1932, it may be granted, little steel went into new uses though there was a continued expansion in the metal container field. On the whole, however, agreement would

be fairly general with consuming industries so prostrate, that total output was below replacement needs. It has been thirty years since production was so low as in 1932. In 1902 consumption was of the order of 13,400,000 tons, while that of last year was 13,500,000 tons. Thus it may be concluded that the average life of steel is less rather than more than 30 years.

As a check on such an analysis, we might allow 50 years as the life of steel going into buildings, 30 years for railroad, oil production, shipbuilding and machinery uses, 7 years for automobile and agricultural steels, 2 years for containers and 20 years for miscellaneous uses; and allowing for the percentages of the whole going into each of these classifications, we arrive at an average life of 26 to 27 years. If 26 years be taken as a measure of the span of replacement, then the basic needs of 1933 are the size of the outputs of 1906 and 1907, or 19,000,000 tons. If the life be taken as averaging 30 years, then the least that 1933 would require is 15,000,000 tons, the rate of consumption of 1903. Neither 15,000,000 tons nor 19,000,000 tons would excite the industry, seeing that even the top figure is only 27 per cent of capacity, but even this larger volume would be 40 per cent better than the 1932 performance while the smaller is actually higher than current estimates for the rate of the first half of 1933.

The Future of Rustless Steels

THE first compilation of production statistics for the stainless and rustless steels was published in *THE IRON AGE* last week. Previously such information had been unobtainable. The data reveal the progress of a new industry, which is destined to expand much beyond its present boundaries. Retarded as it has been by the depression, as the figures show, the output in a short time is sure to recover and pass the peak of 47,171 gross tons, reached in 1930.

It was only about 20 years ago that stainless steel, the forerunner of the low-carbon or rustless steels, was announced by Brearley in England. The work of Strauss in Germany and several American metallurgists has been responsible for the new knowledge of these remarkable and complicated alloy steels, rendering them available in several industries. Steels of this type are now essential in the fixation of nitrogen for the production of nitric acid; they have made possible great advances in the petroleum industry where high temperatures are involved; they are a factor in prolonging the life of equipment used in the paper and pulp industry; they are proving essential in the construction of dairy equipment; they are particularly adapted to resist high temperatures, and they promise to find wide use in the brewing industry when beer is again legalized. Besides these major applications, there is the adaptability of these alloys to architecture and to the automobile. Many other uses are possible because the variety of combinations of alloying elements makes available materials which may meet conditions not now realized.

E. T. Weir Calls Price Cutting Child of Fear, Mother of Panic

Does Not Produce Enough New Business to Compensate—Solution of Depression Must Come From Business Men

"**P**RICE cutting is the child of fear and the mother of panic," declared E. T. Weir, chairman of the National Steel Corp., in an address Friday, Feb. 10, at a dinner of the Eastern States Blast Furnace and Coke Oven Association in Pittsburgh. He declared that he could not recall any instance of a price cutting epidemic which produced anything but harm for those involved.

"The correct prices of goods," he said, "represent the cost of producing them, plus a profit which is the wages of the capital employed. When production costs are lowered, or the amount of capital needed is reduced, the price of the goods can be adjusted, and this is a normal, healthy and necessary operation which cannot be termed 'price cutting.' Price cutting goes further and involves a reckless destruction, first of proper earnings for labor and fair dividends to the stockholders, and then of the invested capital and, finally, of the structure of the industry itself."

"Price cutting originates where an industry is producing more goods than can be consumed, whether because of over-expansion or curtailed demand. In the effort to increase consumption, the price cutter, with his weak backbone and mistaken logic, takes command. He has only one argument—that price cutting will increase consumption, and it is curious to note the widespread acceptance of this argument without evidence to back it up.

Price Cutting Does Not Create Additional Business

"Speaking for the basic industries, of which steel is one, I cannot recall a single instance where price cutting on their products has created enough additional business to compensate for the cut. On the other hand, it is easily demonstrated that it reduces the consumption by eventually affecting the buying power of the public through lower earnings.

"This is due to the fact that basic commodities form only a small part of the cost of the articles in which they are finally consumed. It is a fact that if steel, for instance, were given away free, it would make little difference to the ultimate consumer. The dealer who overtrades on your used car may throw away more than the cost of all the steel in the car; a few dollars will buy all the steel in an electric refrigerator. If the steel in a skyscraper were offered free, there would still be the freight, the han-

dling, and erection to be paid for. Add to that the cost of the land, the financing charges, the cost of the other materials and the labor involved in making them into a building, and the skyscraper would cost almost as much as if the steel had been bought at a fair price.

"As an extreme case, consider a bridge, which consists almost entirely of steel. The George Washington bridge at New York cost approximately \$60,000,000. It contains less than 175,000 tons of steel, which represents approximately \$6,000,000, or about 10 per cent of the total cost.

"It is the same with other commodities. If rubber were free, tires would still cost nearly as much as they do now. If the farmer were to give away his wheat, a loaf of bread would cost almost as much as at present. If bean coffee were to be had for nothing on the Brazilian plantation, the freight, handling, roasting, packaging, and delivery to the restaurant, with the cost of waiters, kitchen help, rent, and other costs would still make a cup of coffee cost about what it does now.

"But the price cutting which is so small to the ultimate consumer is pathetically large to the men who produce the commodity. There is a limit to reducing operating costs other than wages, and it is soon reached. After that, every cost reduction comes out of the pay envelope of the workers. Before the depression, the 700,000 men employed in the steel industry bought many thousands of automobiles, radios, electric refrigerators and countless other articles containing steel. Today, I venture to assert that almost none of these articles are being bought by the workers in the steel industry.

Steel Industry Has Wiped Out Profits, Impaired Capital

"In effect, the steel industry as a whole has wiped out its profits, impaired its capital, brought distress to thousands of its workers, and destroyed a market for millions of dollars worth of its own product, in order to offer a price reduction which seldom amounts to as much as 5 per cent on the finished merchandise, and ranges from that downward to infinitesimal fractions.

"As regards the buyer of basic commodities, the eventual loss of market for his finished products which results from commodity price cutting is a matter for his serious consideration.

"The remedy for price cutting is

simple but not easy. It calls for a greater sense of responsibility on the part of business executives toward their security holders and their employees. It calls for greater effort on their part to convince buyers that price cutting is against the buyers' own interests. And, finally, it calls for united action by the industry to increase consumption of its product, not by such fallacies as price cutting, but by research to discover and hard work to develop new uses and outlets for it. So much for price cutting and its effects—and where are we going?

"Now what is the answer? We cannot proceed as we have been for very long. The temper of the people will not stand it, and certainly they are justified in their resentment of conditions which have no sound economic or social basis—that is, where people cannot find work and cannot make a living. The one great privilege to which every inhabitant of the United States is naturally entitled, which comes to him as a result of a proper form of Government and a fair relationship among all men, is that of making a living—a good living for himself and his family, and sharing in the material things that make life worth living.

Solution of Depression Must Come From Business Men

"I have come to the conclusion that the solution to our problems must come from business men. No other group in the country, political or social, has the training, experience, or knowledge to provide the successful way out. Carrying this responsibility, therefore, business men must organize into a cooperative group, eliminating antagonism of daily competition, and assuming the responsibility for improving the general situation and in the interest of the general good.

"Every man in this room can, and should, do his part and preach this gospel. The terrific responsibility of our position as business men is represented by the millions of unemployed and partially employed and their necessity for work and for earnings that will bring them and their families back to a standard of living that is in harmony with the principles of this country. I am convinced that by concentration we could start improvement in a reasonable length of time because fundamentally we have the tools with which to work.

"Therefore, let each one of us pledge himself, if he believes in this theory, to go out and do his share in trying to start the movement. Let us turn our thoughts from liquidation, and make up our minds we have reached the end, and our faces must be set in the direction of reconstruction.

"Unless business and business men take on this responsibility, I cannot predict, nor can any man in this room, where the end will be, but we do know it will be disastrous."

SUMMARY OF THE WEEK'S BUSINESS

Steel Production Slightly Lower As Automobile Tonnage Recedes

Losses Mainly in Cleveland and in the Valleys, With Other Districts Holding Their Own—Price Stabilization Gaining

STEEL ingot production for the country at large has declined this week to a shade under 19 per cent as the result of a combination of circumstances, chiefly a falling off in automobile tonnage, which has been offset only in part by an increase in releases by the Ford Motor Co. However, the flattening out of steel demand may also be ascribed to unsettlement over a weak price situation and the Michigan bank holiday.

The effect of smaller automobile specifications is most marked at Cleveland, where the ingot rate has declined from 38 to 35 per cent, but is also evident in the Valleys, where a drop from 20 per cent to 17 per cent has occurred. A part of the loss in the latter district is due to the completion of a large pipe order which had raised the production of a Youngstown plant during the first half of this month.

Steel ingot production is sustained at Pittsburgh, Wheeling, Chicago and in nearly all other districts, though at Chicago an expected increase this week has not materialized because of the shutting down of a rail mill for lack of orders. Meanwhile, the Colorado rail mill is starting up on a recent order from the Santa Fe.

THE immediate outlook for the steel industry is still uncertain owing to the lack of a substantial volume of new building work, the almost complete absence from the market of the railroads and the indefiniteness of automobile schedules after this month—three major lines of consumption to which the mills must look for gains if steel output is to rise much above the present low level.

Seasonal activity in building construction has been limited chiefly to the award of small jobs. The larger inquiries are for public work that will be slow in reaching the mills. Railroads have given no positive sign that they will materially increase their takings of steel within the near future, although several inquiries for rails are still counted upon to appear within the next few weeks.

An increase in automobile requirements, or even the maintenance of present volume, is largely dependent upon the activities of the Ford Motor Co., which is far short of its goal of 1200 cars or more a day owing to an insufficient supply of bodies from the Briggs and Murray plants. There is no indication that volume output will be attained for another week or 10

days at least. However, Ford is understood to have released steel for 50,000 cars, the past week's specifications having covered 20,000 of these. Ford orders have helped to sustain rollings at mills that were affected by reduced volume of business from other automobile manufacturers. The Ford company is now asking for prices on parts for its small car, which will be out about May 1. Although the bank holiday has not affected automobile production in Michigan, it has cut down retail sales in that State.

Miscellaneous consumers of steel have contributed most of the gains that have occurred in bookings of some steel products. Steel barrel and refrigerator manufacturers are among those that have been buying steel a little more freely.

PRICE stabilization is the focal point of steel companies' activities. Considerable has already been accomplished through the determination of several producers to stop further concessions, and some outright advances are in prospect, particularly on sheets, in which recent price declines were most marked. Announcements of new sheet prices \$2 to \$4 a ton higher than those now in effect may be made this week, but they will affect an inconsiderable part of the tonnage shipped during the remainder of this quarter because of contract coverage at present levels. Sharp concessions on desirable tonnages of structural shapes and reinforcing bars have virtually disappeared. Wire products have become steadier at the recently announced advances.

PIG iron shipments continue to run ahead of those of January in the Chicago and Cleveland districts, but elsewhere pig iron trade is exceedingly dull. At Birmingham a Sloss-Sheffield furnace has been put out, leaving only two active stacks in that district, one of which is engaged on only a short run. In the East some of the furnaces are declining to meet competition of foreign iron, which is making fresh inroads into some sections.

Scrap markets show a fairly firm undertone, with some minor price advances. The growing export movement, particularly to Japan, has imparted a degree of strength to prices in the East.

THE IRON AGE composite prices are unchanged at 1.923c. a lb. for finished steel, \$13.56 a gross ton for pig iron and \$6.83 for heavy melting scrap.

▲ ▲ ▲ A Comparison of Prices ▲ ▲ ▲

**Market Prices at Date, and One Week, One Month and One Year Previous
Advances Over Past Week in Heavy Type, Declines in Italics**

Pig Iron

Per Gross Ton:

	Feb. 21, 1933	Feb. 14, 1933	Jan. 24, 1933	Feb. 23, 1932
No. 2 fdy., Philadelphia.....	\$13.34	\$13.34	\$13.34	\$15.64
No. 2, Valley furnace.....	14.50	14.50	14.50	15.00
No. 2 Southern, Cin'ti.....	13.82	13.82	13.82	13.82
No. 2, Birmingham.....	11.00	11.00	11.00	11.00
No. 2 foundry Chicago*.....	15.50	15.50	15.50	16.50
Basic, del'd eastern Pa.....	13.50	13.50	13.50	16.25
Basic, Valley furnace.....	13.50	13.50	13.50	14.50
Valley Bessemer, del'd Pittsburgh.....	16.89	16.89	16.89	17.39
Malleable, Chicago*.....	15.50	15.50	15.50	16.50
Malleable, Valley.....	14.50	14.50	14.50	15.50
L. S. charcoal, Chicago.....	23.17	23.17	23.17	23.17
Ferromanganese, seab'd car-lots.....	†68.00	68.00	68.00	75.00

*The average switching charge for delivery to foundries in the Chicago district is 61c. per ton.

†Contract price; spot quotation \$61.

Finished Steel

Per Lb. to Large Buyers:

	Feb. 21, 1933	Feb. 14, 1933	Jan. 24, 1933	Feb. 23, 1932
Hot-rolled annealed sheets, No. 24, Pittsburgh.....	2.00	2.00	2.00	2.15
Hot-rolled annealed sheets, No. 24, Chicago dist. mill..	2.00	2.00	2.10	2.30
Sheets, galv., No. 24, P'gh...	2.50	2.50	2.65	2.75
Sheets, galv., No. 24, Chicago dist. mill	2.50	2.60	2.65	2.85
Hot-rolled sheets, No. 10, Pittsburgh	1.45	1.45	1.45	1.60
Hot-rolled sheets, No. 10, Chicago dist. mill.....	1.55	1.55	1.55	1.70
Wire nails, Pittsburgh.....	1.85	1.80	1.80	1.95
Wire nails, Chicago dist. mill	1.90	1.85	1.85	2.00
Plain wire, Pittsburgh.....	2.10	2.10	2.10	2.20
Plain wire, Chicago dist. mill	2.15	2.15	2.15	2.25
Barbed wire, galv., Pittsburgh dist. mill	2.35	2.30	2.30	2.60
Barbed wire, galv., Chicago dist. mill	2.40	2.40	2.40	2.65
Tin plate, 100 lb. box, P'gh..	\$4.25	\$4.25	\$4.25	\$4.75

Rails, Billets, etc.

Per Gross Ton:

	Feb. 21, 1933	Feb. 14, 1933	Jan. 24, 1933	Feb. 23, 1932
Rails, heavy, at mill.....	\$40.00	\$40.00	\$40.00	\$43.00
Light rails at mill.....	30.00	30.00	30.00	34.00
Rerolling billets, Pittsburgh.....	26.00	26.00	26.00	27.00
Sheet bars, Pittsburgh.....	26.00	26.00	26.00	26.00
Slabs, Pittsburgh.....	26.00	26.00	26.00	27.00
Forging billets, Pittsburgh.....	31.00	31.00	31.00	33.00
Wire rods, Pittsburgh.....	35.00	35.00	35.00	37.00
Cents	Cents	Cents	Cents	Cents
Skelp, grvd. steel, P'gh, lb..	1.60	1.60	1.60	1.50

Finished Steel

Per Lb. to Large Buyers:

	Feb. 21, 1933	Feb. 14, 1933	Jan. 24, 1933	Feb. 23, 1932
Bars, Pittsburgh.....	1.60	1.60	1.60	1.50
Bars, Chicago.....	1.70	1.70	1.70	1.60
Bars, Cleveland.....	1.65	1.65	1.65	1.55
Bars, New York	1.95	1.95	1.95	1.85
Tank plates, Pittsburgh.....	1.60	1.60	1.60	1.50
Tank plates, Chicago.....	1.70	1.70	1.70	1.60
Tank plates, New York.....	1.698	1.698	1.698	1.798
Structural shapes, Pittsburgh.....	1.60	1.60	1.60	1.50
Structural shapes, Chicago..	1.70	1.70	1.70	1.60
Structural shapes, New York 1.86775	1.86775	1.86775	1.86775	1.76775
Cold-finished bars, Pittsburgh.....	1.70	1.70	1.70	2.00
Hot-rolled strips, Pittsburgh.....	1.45	1.45	1.45	1.40
Cold-rolled strips, Pittsburgh.....	1.80	1.80	1.90	1.90

Old Material

Per Gross Ton:

	Feb. 21, 1933	Feb. 14, 1933	Jan. 24, 1933	Feb. 23, 1932
Heavy melting steel, P'gh....	\$8.50	\$8.50	\$8.25	\$10.25
Heavy melting steel, Phila....	6.75	6.75	6.75	7.37 1/4
Heavy melting steel, Ch'go..	5.25	5.25	5.25	7.12 1/4
Carwheels, Chicago.....	8.00	8.00	7.75	7.50
Carwheels, Philadelphia.....	8.00	8.00	8.00	10.50
No. 1 cast, Pittsburgh.....	9.00	9.00	9.00	9.75
No. 1 cast, Philadelphia.....	8.00	8.00	8.00	10.00
No. 1 cast, Ch'go (net ton)..	6.25	6.25	6.25	7.50
No. 1 RR. wrot., Phila.....	7.50	7.50	7.50	8.50
No. 1 RR. wrot., Ch'go (net)	4.50	4.50	4.50	6.50

Coke, Connellsville

Per Net Ton at Oven:

	Feb. 21, 1933	Feb. 14, 1933	Jan. 24, 1933	Feb. 23, 1932
Furnace coke, prompt.....	\$1.75	\$1.75	\$1.75	\$2.25
Foundry coke, prompt.....	2.50	2.50	2.50	3.50

Metals

	Per Lb. to Large Buyers:	Cents	Cents	Cents	Cents
Lake copper, New York.....	5.00	5.00	5.00	6.50	
Electrolytic copper, refinery.	4.75	4.75	4.75	6.00	
Tin (Straits), New York....	23.45	23.60	23.00	22.25	
Zinc, East St. Louis.....	2.60	2.65	3.00	2.32 1/4	
Zinc, New York.....	2.97	3.02	3.37	3.19 1/4	
Lead, St. Louis.....	2.87 1/2	2.87 1/2	2.87 1/2	3.55	
Lead, New York.....	3.00	3.00	3.00	3.75	
Antimony (Asiatic), N. Y...	5.62 1/2	5.75	5.80	6.75	

On export business there are frequent variations from the above prices. Also, in domestic business, there is at times a range of prices on various products, as shown in our market reports on other pages.

▲ ▲ ▲ The Iron Age Composite Prices ▲ ▲ ▲

Finished Steel

Feb. 21, 1933
One week ago
One month ago
One year ago

1.923c. a Lb.
1.923c.
1.923c.
1.926c.

Based on steel bars, beams, tank plates, wire, rails, black pipe, sheets and hot rolled strip. These products make 85 per cent of the United States output.

1932 1.977c., Oct. 4; 1.926c., Feb. 2
1931 2.037c., Jan. 13; 1.945c., Dec. 29
1930 2.273c., Jan. 7; 2.018c., Dec. 9
1929 2.317c., April 2; 2.273c., Oct. 29
1928 2.286c., Dec. 11; 2.217c., July 17
1927 2.402c., Jan. 4; 2.312c., Nov. 1

Pig Iron

\$13.56 a Gross Ton
12.56
13.56
14.47

Based on average of basic iron at Valley furnace and foundry irons at Chicago, Philadelphia, Buffalo, Valley and Birmingham.

1932 \$14.81, Jan. 5; \$13.56, Dec. 6
1931 15.90, Jan. 6; 14.79, Dec. 15
1930 18.21, Jan. 7; 15.90, Dec. 16
1929 18.71, May 14; 18.21, Dec. 17
1928 18.59, Nov. 27; 17.04, July 24
1927 19.71, Jan. 4; 17.54, Nov. 1

Steel Scrap

\$6.83 a Gross Ton
6.83
6.83
6.25

Based on No. 1 heavy melting steel quotations at Pittsburgh, Philadelphia and Chicago.

1932 \$8.50, Jan. 12; \$6.42, July 5
1931 11.33, Jan. 6; 8.50, Dec. 29
1930 15.00, Feb. 18; 11.25, Dec. 9
1929 17.58, Jan. 29; 14.08, Dec. 2
1928 16.50, Dec. 31; 13.08, July 2
1927 15.25, Jan. 11; 13.08, Nov. 22

Pittsburgh Steel Output At Unchanged Rate; Valleys Lower

Shipments of Automobile Tonnage Lighter, Although Some Mills Benefit From Ford Business—Prices Steadier

PITTSBURGH, Feb. 21—Business in this district has not changed appreciably in the last week. Although new buying is scarcely holding up to the average of the first half of the month, releases are just about holding their own.

Shipments to the automotive industry are reported to be slightly lighter by some companies, but those benefiting by Ford business report an upturn. Railroads have not come into the market, although at least five large carriers in the East are believed to be considering purchases this spring. Structural steel orders are increasing to some extent, but small jobs predominate. Tin plate specifications have held up fairly well, but production is off slightly this week.

Steel ingot output in the district is barely holding its own at 16 per cent of capacity. Most of the smaller independent plants in the district are active on limited schedules, but the larger interests producing the heavier products are experiencing difficulty in maintaining their recent schedules. Steel production in the Valleys has dropped to about 17 per cent, but the Wheeling district continues at the same rate as last week.

Price stabilization in the industry generally is receiving considerable attention, and a leading maker of sheets is expected to issue new schedules this week, calling for advances in price as well as revisions in extras. The market on heavy hot-rolled products continues to improve, as sharp concessions on desirable tonnages of reinforcing bars and shapes have now practically disappeared.

Pig Iron

A few local jobbing foundries have increased their melt slightly this month, but most of them are using large percentages of scrap, and demand for pig iron has not improved materially. Prices continue nominal and unchanged. The Shenango furnace at Sharpsville, Pa., has been blown out.

Semi-Finished Steel

The market on billets, slabs and sheet bars continues to be well maintained at \$26, Pittsburgh, although scarcely any new buying has been reported. Shipments this month have not improved much over those of January. Forging billets are in slightly better demand, with the price firm at \$31, Pittsburgh. Wire rods are quiet and quotable at \$35, Pittsburgh or Cleveland.

Rails and Track Accessories

One mill reports a slight improvement in miscellaneous specifications for track supplies. No new buying is reported. Purchases of rails by two or three carriers are said to be forthcoming in the near future, but nothing definite has come out.

Bars, Plates and Shapes

While business has shown no definite improvement in the last week, there has been no falling off in orders, and structural inquiry continues to pick up. Most of the jobs are small, but a few outstanding projects, such as the San Francisco-Oakland bridge, are still before the trade. Plates are rather quiet, but barge yards are taking some tonnage, and a Pittsburgh district builder has taken an order for 100 mine cars to be exported. Merchant bars are in steady demand, and there has been a slight increase in miscellaneous tonnage. Alloy steel bars are moving to the automobile industry in sustained volume. Efforts toward price stabilization on the heavy hot-rolled products are still being carried on. The 1.60c., Pittsburgh, price applies rather generally on small tonnages, and concessions of more than \$2 a ton on desirable business are disappearing. The price of reinforcing bars is expected to be advanced on March 1.

Cold-Finished Steel Bars

Improved orders are reported by most makers, but the volume is no larger than it was during the low months last summer. Operations are very light, but the price is holding at 1.70c. base, Pittsburgh.

Tubular Goods

Practically all makers report a slight loss in the volume of oil country material. The other consuming lines are holding their own, with some slight expansion in mechanical tubing demand. Definite line pipe projects are still lacking, but talk of extending the Columbia Gas & Electric Co. natural gas line from Washington into Philadelphia is reported. This would require a fair-sized tonnage of large diameter pipe.

Wire Products

An advance in prices on merchant wire products announced last week, brought out some new orders, and specifications are slightly improved. However, business is still very unsatisfactory, and mills may find it necessary to advance quotations again in an effort to get back some of the

ground lost earlier in the year. Manufacturers' wire is in fair demand from the automotive industry, but spring wire is generally dull.

Sheets

In the absence of any change in demand for sheet mill products, interest in the market is centered on prospective changes in classifications and prices. It is now generally understood that a leading maker will announce important changes in bases and extras later this week, and that new prices to be named will be somewhat above the current quoted levels. Several mills have already established a minimum price of 2.60c., Pittsburgh, on galvanized sheets, which has been generally observed on recent orders. On hot-rolled annealed sheets quotations have been less clearly defined, with considerable business placed at less than 2c., Pittsburgh. The other grades have not changed materially in the last week, and the market has a firmer tone in view of changes under consideration. Production continues at about 18 per cent of capacity, but automotive tonnage has begun to taper off with many mills. Miscellaneous demand from other sources is light but fairly steady.

Tin Plate

April specifications, which were due last week, brought in a fair amount of tonnage, but some mills have already rolled material this far ahead. Under the circumstances, production has eased off slightly, and is not above 45 per cent this week.

Strip Steel

The last week has been a quiet one, as the banking situation in Detroit was not conducive to the making of forward commitments. However, specifications against contracts are still holding up fairly well. The price of hot-rolled strip continues to hold at 1.45c., Pittsburgh, but little progress has been made in stabilizing the market on cold-rolled strip. If the unsatisfactory price situation in the sheet market can be corrected, cold-rolled strip will probably be adjusted also.

Coal and Coke

Demand for foundry coke shows little change, with shipments this month running at about the same rate as in January. Prices are not strong, but 72-hr. coke is generally quoted at \$2.50, Connellsville. Furnace grade is very quiet. Heating coke is also less active, and warmer weather has brought abatement in demand for domestic coal.

Ferroalloys

Makers of ferromanganese have reduced their prices \$7 a ton to \$61, seaboard, on spot shipments. The move was made to meet foreign competition, and it is planned to hold this level for only a short period. While contracts will not be written down,

shipments will be made against them at the \$61 price so long as it remains effective on spot sales.

Scrap

No buying of heavy melting steel by consumers has been reported in the last week, and the market continues quotable at a wide range. Very little steel is available at less than \$8.25, but distress cars can occasionally be picked up at \$8. Hydraulic compressed sheets have advanced on a sale of a fair-sized tonnage at better than \$8.75. A company in the district is buying steel car axles and iron car wheels, apparently for investment purposes, and is paying \$10 for axles and \$8 for wheels. Not much material is coming out at these figures.

Willys-Overland Co. In Receivership

The Willys-Overland Co., Toledo, one of the country's larger automobile manufacturers for over a quarter of a century, has gone into receivership on petition of the Monroe Auto Equipment Co., a creditor. John N. Willys, chairman of the board, and L. A. Miller, president, have been appointed receivers. The bill of complaint declares that Willys-Overland has current obligations of \$1,500,000 and funded debt of \$2,000,000, of which \$1,000,000 was in default last September. Cash, accounts receivable and other assets are more than \$2,500,000. The company has capital liabilities of \$12,776,300 in preferred stock and \$14,999,410 in common stock of \$5 par value. The plant has been carried at a depreciated value of \$31,000,000.

The receivership will not affect subsidiary companies, except indirectly, and the agreement for truck manufacture with International Harvester Co. will be carried out. The receivership order gave the receivers broad powers to operate the plants, borrow funds, develop current new business and prohibit any creditors from bringing bankruptcy action against the company without court permission.

National Tube To Use Diescher Patents

The National Tube Co., Pittsburgh, has been licensed by Diescher Tube Mills, Inc., to manufacture seamless tubular goods under the Diescher patents. A mill is now being designed for installation at Ellwood works, Ellwood City, Pa., which will produce tubing up to 4½-in. O.D. The new unit, which will be installed at an early date, will replace an existing mill and utilize present equipment wherever possible.

Continental Steel Prices Firm; British Trade Is Expanding

LONDON, England, Feb. 20 (By Cable)—British pig iron consumers are buying more freely. Japan has bought 1500 tons of East Coast hematite.

Steel demand from the dominions is expanding and British works are now awaiting orders from shipbuilding companies. Tin plate is quiet except for a further large amount for June-December shipment booked privately by works and believed to be for Canada.

Continental steel prices are firm on reconstitution of the Raw Steel Cartel and on forthcoming sales agencies which are expected to be arranged for at Dusseldorf on Feb. 24. It is understood that the cartel will control exports based on foreign shipments during the first half of 1932, which will give a total annual export quota of participating countries amounting to 6,800,000 metric tons.

Italy and Japan have bought further quantities of Belgian semi-finished steel.

The Neunkirchen disaster has forced the closing of the Neunkirchener Eisenwerk coke plant, but the blast furnaces are intact and the resumption of steel rolling is expected at an early date.

Spanish steel works have sold steel rails at a value of about £250,000

British Prices, f.o.b. United Kingdom Ports

Per Gross Ton

Ferromanganese,	
export	49
Billets, open-hearth	£5 to £5 7s. 6d.
Black sheets, Jap-	
anese specifi-	
cations	£11
Tin plate, per base	
box	15s. 9d. to 16s.
Steel bars, open-	
hearth	£7 17½s. to £8 7½s.
Beams, open-hrth.	£7 7½s. to £7 17½s.
Channels, open-	
hearth	£7 12½s. to £8 2½s.
Angles, open-	
hearth	£7 7½s. to £7 17½s.
Black sheets, No.	
24 gage	£8 10s.
Galvanized sheets,	
No. 24 gage	£10 10s. to £10 15s.

Continental Prices, f.o.b. Continental Ports

Per Metric Ton, Gold £ at \$4.86

Billets, Thomas	£2 4s.
Wire rods, No. 5	£1 10s.
B.W.G.	£1 10s.
Black sheets, No.	
31 gage, Jap-	
anese	£11 5s.
Steel bars, mer-	
chant	£2 12s. 6d. to £3
Beams, Thomas...	£2 5s.
Angles, Thomas	4-in. and larger £2 11s.
Angles, small ...	£2 18s.
Hoops and strip	
steel over 6-in.	
base	£3 12s. 6d. to £3 15s.
Wire plain, No. 8	£5 7s. 6d.
Wire nails	£5 15s.
Wire, barbed, 4-pt.	
No. 10 B.W.G.	£8 15s.

sterling to Argentina, taking corn in exchange. Spain has also booked an order for five gunboats and 12 coast guard vessels for Mexico.

Foreign Steel Attacked at California Conference

At the ninth annual conference of the Iron, Steel and Allied Industries of California, held at Del Monte on Feb. 9-11, the theme was modernization of production methods and improvement in practices of distribution. A. H. Diehl, president, Columbia Steel Co., and W. H. Stewart, president, Pacific Coast Steel Corp., both stated that foreign steel was being imported to the detriment of American business and the welfare of the entire Coast. They pointed out that large investments had been made in steel plants in the West and that, if distributors cooperated to the fullest extent, employment would be increased from the additional steel production on the Pacific Coast.

Charles F. Abbott, executive director of the American Institute of Steel Construction, Inc., gave an interesting discussion on "The New Era for Steel."

The conference endorsed the program of the California State Chamber of Commerce calling for a reduction in governmental expenses and for rigid economy. A resolution was adopted, urging that, in case of receiverships, trade groups or associations affected exert every possible effort to see that the appointment of the receiver be one experienced in the particular line so that he will not injure the industry. The conference unanimously favored the prohibiting of the sale of prison made goods in California and limiting the sale of goods manufactured in California prisons to furnishing the needs of the wards of the state.

The executives attending, numbering about 150, represented steel fabricating plants, reinforcing bar dealers, pipe distributors, foundries.

E. Jungquist, Percival Steel & Supply Co., Los Angeles, was made chairman for the coming year. W. W. Glosser, Hubbard & Co., Emeryville, will be vice-chairman. C. S. Knight will continue as secretary.

Bids will be called soon for wharf, dolphins, trestle, land trackage, etc., at Sand Island in Columbia River near Astoria, Ore. This project will require about 24 tons of bolts and spikes and 180 tons of steel rails.

Chicago Steel Output Holds Steady; Rail Production Stops

Specifications Continue at Recent Rate But Are Not Gaining—
Mills Taking a Firmer Stand on Prices

CHICAGO, Feb. 21—Although finished steel specifications are holding to the gains recently registered, ingot output has not advanced because local rail production has ceased. However, the Colorado mill is calling men to work as rollings start on the Santa Fe rails.

Prices show somewhat of a mixed tendency, but they have the background of producers' determination to bolster the structure for second quarter delivery. Galvanized roofing sheets are off \$2 a ton and No. 10 hot-rolled sheets are no longer quotable at the high of the recent spread. Hot-rolled strips are lower and pressure is being exerted against shapes and plates. On the other hand, wire producers are attempting a stand against recent low prices and are dropping the lower prices where spreads in quotations had been the rule.

The banking situation in Michigan is having telling effect on sales of wire products. Iowa is curtailing its road construction program and, with the same tendency noted in other States, road machinery builders are slowing down output. Shipments of steel for automobiles remain steady.

Pig Iron

New buying of Northern foundry iron is still spotty and as a general rule in small lots, though occasionally an attractive tonnage makes its appearance. Shipments thus far in February still show improvement over the January rate.

Reinforcing Bars

The desire to strengthen and even advance prices for reinforcing bars is taking a firm hold on mills, and it is to be expected that dealers will follow the lead. Illinois road work bids that have been thrown out have not been readvertised. Practically all the steel needed on contracts that were let has now been placed with dealers, the aggregate being near 2000 tons. Private work remains light and is represented by a packing plant, some brewery work and several small jobs for the World's Fair.

Cast Iron Pipe

Of the 800 tons of pipe that may eventually be used for the Wilmette, Ill., water plant, about 425 tons (3000 ft.) will be for a 30-in. intake. There is some doubt whether this intake will be made of steel or cast iron pipe. The Chicago district market remains very light for all classes of work.

A few plans are now under way, but these are still rather indefinite. In the absence of tests, prices for 6-in. and larger pipe are \$33 a ton, Birmingham, or \$41.40, delivered Chicago.

Bolts, Nuts and Rivets

Producers will soon start to prepare second quarter contracts which, as now planned, will be submitted at present quotations. Demand remains sluggish, with most consumers taking only very small lots.

Hot-Rolled Strip

This commodity is moving in greater volume to frame manufacturers, who are swinging into production preparatory to the introduction of new low-priced automobiles. Prices for all widths up to 24 in. range from 1.45c. to 1.55c. a lb., Chicago.

Sheets

Producers' opinions as to prices continue to vary, notwithstanding the desire of some sellers to pull the structure up. Galvanized sheets for roofing purposes are going at 2.50c. a lb., Chicago mills, whereas the bundled product commands 2.60c. No. 10 hot-rolled sheets are being quoted at a flat 1.55c. a lb., Chicago mills. Demand for roofing sheets has started in a small way in the North. The movement so far indicates extreme caution on the part of buyers.

Wire Products

Efforts to stabilize prices are meeting with success in this district. Standard wire nails are priced at \$1.90 a keg, Chicago, and barbed wire is priced at 2.40c. a lb., Chicago. Demand for wire products from manufacturing centers is steady, but use in farm areas is faltering, especially where, as in Michigan, the banking situation is unfavorable. The recent purchase of a large amount of electrical cable by a California utility company is an outstanding event in this market. A factor contributing to the dullness of the copper wire market is the fact that some utility operating companies have installed braiding machines and are weatherproofing a large amount of reclaimed conductor wire.

Rails and Track Supplies

The Colorado rail mill is calling men back to work preparatory to producing the tonnage ordered by the Santa Fe. The Chicago mill that has been on a light schedule for several

weeks is now out of service. There is still no word from the railroads as to rails that will be ordered this spring. Track supplies are moving at the average of recent weeks.

Plates

The trade is still anxiously awaiting developments in oil producing areas, where larger plate business is expected to develop. In the meantime, only a few hundred tons of plates are moving to tank shops. The Denver pipe line, which called for about 4000 tons, has been abandoned and a temporary job of light construction is to be undertaken. It is understood, however, that the original plans will be revived some time in the future. The intake for the Wilmette, Ill., water pumping plant is still a controversial subject. It was originally planned to make it of cast iron pipe, but recently the designers have decided to give consideration to 3000 ft. of steel pipe. The only railroad news is the report of a contemplated purchase of four lounge cars by the Missouri-Kansas-Texas.

Structural Material

Awards and inquiries are very slim and prospects are far from bright. There is a disposition for States to curtail road work, and there is nothing of interest in the way of private work. Low bidders have been announced in the St. Paul post office.

Bars

Automobile and general manufacturing support to the bar market is well sustained at the gains noted a week ago. Tractor plants are holding to fair schedules, but road machinery manufacturers have reduced output because of the tendency on the part of some States to curtail road work. Inquiry for rail steel bars is larger, but shipments remain small. Fence posts have been reduced \$5 a ton.

Coke

The use of foundry coke is slowly creeping upward. Prices are steady at \$7 a ton, local ovens.

Scrap

Yards have now been cleared of snow and scrap is moving in a normal but small way. One steel mill continues to take small offerings of heavy melting steel at \$5.50. Another mill is refusing shipments, while the largest producer of steel continues the policy of reducing its stock pile. Foundries are beginning to take more scrap. The Burlington is offering a list of 3500 tons.

A 250,000-gal. elevated steel storage tank, filters, pumps, and mile of cast iron pipe will be purchased by Mount Carmel, Ill., in connection with improvements to its waterworks system. The materials will cost about \$58,000, which will be obtained from a loan of \$96,000 made by the Reconstruction Finance Corporation.

Eastern Pennsylvania Trade Displays a Better Feeling

Business Not Generally Improved, But Prices Are Being Strengthened—Two Mills Buy No. 2 Steel Scrap

P HILADELPHIA, Feb. 21.—There is a better feeling in the trade generally. It is based partly on the fact that some mills have seen a slight bulge in bookings, especially in shapes and merchant bars. Perhaps the improved sentiment is due more, however, to the firmer stand taken to stabilize prices on heavy rolled material, sheets and wire and wire products. Some mills report that bookings in February have equaled those of October and November, though exceptions were made as to plates and sheets. On the other hand, other makers report that February orders were no better than those of January and were the smallest since last August.

The trade is looking forward with the hope that March, ordinarily a high production month, will see a fair improvement in business.

With one open-hearth furnace closing down, operations have declined one-half point to 10½ per cent of district capacity.

Pig Iron

A slight increase in bookings has developed and is confined to foundry grades. Orders are principally for carlots, with an occasional 500-ton lot booked. The \$7 drop to \$61 for standard ferromanganese applies to shipments made in February, though the term may be broadened to cover a longer period. The decline was made by reason of competition from Germany. A tonnage from that country is reported to be destined to this port for early delivery.

Plates, Shapes and Bars

Some makers report a moderate increase in orders, particularly for structural shapes and merchant bars. The trade is taking a firmer stand and as a result the price structure is better established, though plates at 1.50c. to 1.60c., Coatesville, continue to reflect irregularity. Shapes are quoted at 1.60c., Eastern mills, and bars at 1.60c., Pittsburgh. Reinforcing bars take a range of 1.30c. to 1.40c., Pittsburgh, but an advance may be announced.

Sheets

Sheet makers report a better sentiment has developed from the stronger price stand. The quotation of 2.60c., Pittsburgh, on No. 24 galvanized sheets apparently is being well adhered to generally. It is required that sheet specifications against contracts be in the hands of mills by March 31 for shipment prior to April 15.

Warehouse Business

Jobbers report that February orders were under those in January from a point of volume but were better from a point of value. The market continues to be affected by importations.

Imports

The following iron and steel imports were received here last week: 55 tons of pig iron from British India and two tons of steel bars from Sweden.

Scrap

An eastern Pennsylvania mill has just purchased 5000 tons of No. 2 heavy melting steel at \$5, delivered, on an exchange basis for low phosphorous and low sulphur crop ends. It is reported that about 4000 tons of this grade was also bought last week by another eastern Pennsylvania melter. Prices are unchanged.

Alabama Stack Put Out; Steel Orders Gain Slowly

BIRMINGHAM, Feb. 21—No improvement has developed in the pig iron market and none is in early prospect. This situation is making further curtailment of production necessary. Sloss-Sheffield Steel & Iron Co. banked its No. 2 furnace last week and will be out of production for about 60 days. This leaves two blast furnaces active in Alabama, these being Fairfield No. 6 of the Tennessee Coal, Iron & Railroad Co. on basic iron and Woodward No. 3 of the Woodward Iron Co. on foundry iron. This latter stack resumed operations on Feb. 8, having been banked for about two months. It is likely that it will again be banked around the first of the month, as the resumption was to be only for a brief period to replace shortages in certain grades. Shipments so far during February have not been much better than for the same period in January. Pipe bookings are irregular, with inquiries somewhat better but current tonnage is still low. The pig iron price of \$11 for the Southern market is being maintained.

Steel

There has been a moderate upward trend in bookings during the past three weeks. This new business has consisted mostly of small orders from an increased number of customers. Bars, plates and shapes are more active, in a limited way, than they have been for some time. Bad weather and unsettled prices have restricted some

buying that was expected at this time. However, prices are now firmer. The rail mill of the Tennessee Coal, Iron & Railroad Co. operated last week. The schedule for this week calls for two or three days the latter part. Seven open-hearts were active in Alabama last week and there will be no change this week.

Cincinnati Pig Iron Sales Make a Gain

CINCINNATI, Feb. 21—Although total bookings of pig iron the past week improved, the closing of banks in Michigan for eight days has had a disturbing effect upon the local market. Several automotive foundries received "stop" orders from Michigan automobile manufacturers which in turn caused a cessation of negotiations for pig iron to cover possible needs. In addition, an eastern Ohio melter who was in the market on a tentative inquiry for 800 tons of Northern iron postponed consideration of quotations for 30 days, pending the outcome of the Michigan situation as reflecting upon the activity among automobile manufacturers. An Indiana melter bought 300 tons of Northern foundry iron the past week, but other business was in small lots. Competition on the Indiana order from furnace representatives of other districts is reported to have produced close quotations, but the actual figures were not disclosed.

Steel

A well sustained demand for sheets at better than 30 per cent of capacity output contributes a bright aspect to the district steel market. Interest from stove and refrigeration manufacturers is better, while miscellaneous demand continues to show signs of improvement. Reports of higher prices brought some inquiry for second quarter, but district mills are quoting present schedules only through this quarter.

Scrap

While the price of 3500 tons of uncut structural steel bought for this market from the Louisville & Nashville Railroad was not disclosed, the purchase has had no effect upon present quotations. One or two mills are accepting some material on old contract, but no tendency to make new commitments has developed.

Detroit Scrap Market Firm

DETROIT, Feb. 21.—The local scrap market has been largely devoid of interest, but prices have remained firm. Borings and turnings are up 25c. a ton as a result of the effort of dealers to cover short orders for delivery to a district blast furnace. Small Michigan dealers have been seriously handicapped the past week by the bank moratorium throughout the State, having had to do business on a cash basis.

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Cleveland Steel Business Has Gained Slightly This Month

Production Off to 35 Per Cent Because of Decline in Automobile Tonnage—Miscellaneous Orders Increasing

CLEVELAND, Feb. 21—The volume of business in finished steel made some further gain the past week, and the total tonnage to be entered this month will show a moderate gain over that of January. Miscellaneous orders have comprised the bulk of the tonnage, not much of which came from the automotive industry. With the reduced production schedules by some of the automobile manufacturers, demand from that source is declining, although the clearing up of labor troubles in Detroit resulted in some releases from the Ford Motor Co. during the week.

Steel ingot production in Cleveland has dropped back three points this week to 35 per cent of ingot capacity by the shutting down of an open-hearth furnace by the Otis Steel Co.

Sheets are moving somewhat better to steel barrel and refrigerator manufacturers and some other industries, and this improvement helps to offset the slackening in the demand from the motor car industry. New business has included some fair orders for structural material from fabricators for jobs recently placed.

A determined effort evidently is under way to place on a higher basis prices on products that have declined recently. This is particularly true of sheets, on which an early advance in quoted prices is looked for, although the minimum quotations that have prevailed recently have remained in effect the past week.

Pig Iron

Shipments show a slight gain over those of February and are considerably in excess of sales. Consumers are continuing their policy of buying in small lots for immediate and known requirements. While some 100-ton orders are being taken, most of the business is in car lots. The only inquiry of any size is from a southern Ohio melter for 250 tons. With no improvement in orders for castings, operations of jobbing foundries remain irregular. Prices are unchanged.

Iron Ore

Consumption of Lake Superior ore in January was 661,116 tons, an increase of 31,001 tons over December. This compared with 1,153,560 tons consumed in January last year. Furnace stocks Feb. 1 amounted to 25,680,542 tons. Ore at furnaces and Lake Erie docks on that date amounted to 30,812,119 tons against 36,893,312 tons on Feb. 1 last year. Central district furnaces in January used 351,957 tons of ore, an increase of 39,815 tons and all-rail furnaces used

4138 tons, a gain of 3472 tons. Lake front furnaces consumed 303,594 tons, a decrease of 12,163 tons and Eastern furnaces melted 1427 tons, a loss of 123 tons. There were 43 furnaces in blast using Lake ore Jan. 31, an increase of two for the month.

Sheets

Some mills have received additional releases from the Ford Motor Co., which have enabled an increase in operations, although orders from some other automotive sources show a decline. Demand has improved from consumers in other fields. Fair lots of black sheets were placed during the week by steel barrel manufacturers, of enameling sheets by refrigerator manufacturers and of tin mill black plate by makers of kitchen ware. While 2c., Pittsburgh, on hot-rolled annealed sheets and other minimum prices that have been quoted recently are still in effect, efforts to put prices on a better basis are expected to be made in an announcement of price advances before the end of the week.

St. Louis Pig Iron Melt Showing a Pick-up

ST. LOUIS, Feb. 21—Quite a little pick-up in the melt of pig iron by jobbing foundries in the district and nearby territory is reported. Stove plants are making progress and are planning to order additional pig iron beginning March 1. Shipments of the local maker for February are expected to be considerably ahead of those of January. Prices are unchanged.

Steel

The St. Louis-San Francisco Railway has released for March shipment 1000 tons of 110-lb. rails on an old contract with the Tennessee Coal, Iron & Railroad Co.

Final plans have been approved for the Federal Building here, which will require 6500 tons of structural steel; Mauran, Russell & Crowell, St. Louis, are architects.

State of Missouri will open bids March 4 for six highway bridges, requiring a total of 1573 tons of structural steel, and highways that will require between 750 and 1000 tons of wire mesh. Mississippi Valley Structural Steel Co. has been awarded 40 pontoons, requiring 250 tons of structural steel, for the United States Engineers' Office at Vicksburg, Miss.

These advances, if announced, will probably apply to the second quarter. In the meantime, some consumers are endeavoring to cover at present minimum prices for delivery beyond the current quarter. Local jobbers have reduced warehouse prices on galvanized sheets \$5 per ton.

Strip Steel

New demand for both hot and cold-rolled strip is slow. Prices are unchanged at 1.45c., Pittsburgh, for hot-rolled material and 1.80c. to 2c., Cleveland, for cold-rolled strip.

Bars, Plates and Shapes

Miscellaneous orders for bars show some improvement. Demand for alloy steel bars from some of the local forge shops has gained. There is a lack of new inquiry in the structural field. Public work, both Federal and State, is expected to be less this year than last. Demand for plates for miscellaneous tank work has improved. Prices are firm at 1.65c., Cleveland, for bars, and 1.60c., Pittsburgh, for plates and shapes.

Scrap

There is some demand from dealers for steel-making and blast furnace scrap for delivery to Valley mills, and prices on some grades are firmer. Dealers are paying \$8 to \$8.25 for heavy melting steel for shipment to these mills and \$7.50 for compressed sheet steel. Locally the market is inactive, with prices unchanged.

Scrap

Because of low prices, the Missouri Pacific Railway sold only 4500 tons—all yard items—of its offered list of 7800 tons of scrap iron. Ann Arbor Railroad offers 275 tons.

Boston Pig Iron Market At a Standstill

BOSTON, Feb. 21—The pig iron business is virtually at a standstill, and no prospective business of importance is in view. The New England melt is still less than 10 per cent of rated capacity. Enough Dutch iron is stored at Providence, R. I., and Bridgeport, Conn., to supply New England foundries with all the iron they will need the next four or five months at the current rate of buying if nothing but Dutch iron is purchased. Such iron is available at less than \$13.75 a ton on dock or around \$14.50 a ton, delivered within trucking distance.

Activity in scrap still centers in the export market. A steamer is loading 3000 to 4000 tons at Chelsea, Mass., for shipment to Danzig, and negotiations are under way for Japanese business. For domestic consumption, sales are confined to a carlot now and then of No. 1 heavy melting steel, chemical borings, engine blocks and breakable cast.

New York Steel Business is Holding at Recent Levels

Some Spotty Improvement Reported But Also Some Declines in Orders—Efforts Being Made to Strengthen Prices

NEW YORK, Feb. 21—Steel business in the New York territory is just about holding its own. There have been declines in orders for some products, but others have gained moderately, so that aggregate tonnage has held about even. Tin plate specifications have improved for some companies.

Interest in the price situation centers in efforts of the mills to strengthen sheets. Galvanized material is now quite generally quoted at 2.60c. a lb., Pittsburgh, but the amount of business at this level is small because most consumers and distributors recently covered for the quarter at lower prices. There has been a movement on foot to establish a new classification of sheets, but it does not appear certain that this program will be carried out owing to opposition from some quarters. The outcome may be a flat advance of \$2 to \$4 a ton on various grades, with the present classification retained.

Pig Iron

Prospective arrival this week of a sizable cargo of Royal Dutch iron at Port Newark will mark the initial entry of foreign iron through that port. Though Port Newark had long been considered a likely point of entry for serving northern New Jersey consumers, lack of competitive freight rates and high handling charges had eliminated it until recently, when new rates, comparing favorably with those in effect from Jersey City and Elizabethport, were established. Utilization of facilities at Port Newark will place Royal Dutch iron more directly in competition in northern New Jersey with Buffalo iron, which is carried at Jersey City and Elizabethport, and with eastern Pennsylvania brands. Little change in demand was noted during the week. Sales of about 800 tons equaled those in the preceding period and compare with 600 tons a fortnight ago. With inquiry still restricted to minor lots, prices are untested.

Reinforced Bars

Bids will be opened March 6 on a State highway project at Newark, N. J., requiring about 715 tons. Other fresh specifications reveal only minor bar requirements. Recent awards have all been small. There are indications that strength in prices for other steel products will soon extend to bars. Though no official revisions have been announced, a large bar mill is contemplating establishment of mill lengths at 1.65c., Pittsburgh, a \$3 a ton increase over the prevailing schedule. The higher price, it is said,

may be made applicable to second quarter business. Meanwhile, prospective purchases of round tonnages for several major projects that are still pending are expected to provide a test that will enable mills to determine their price policies.

Scrap

With domestic demand still quiet, the exodus of heavy melting grades

to Japan and Europe continues to dominate interest here. Prices have maintained recent firmness, with No. 1 and No. 2 steel unchanged at \$5 and \$3.50 to \$4, on barge, respectively. Speculation among local dealers has been aroused by the possible effect on commerce if Japan should withdraw from the League of Nations. With a trade embargo likely to ensue in such event, movement of American scrap to Japan would obviously cease. It is in anticipation of this contingency, some observers contend, that demand from Japan in recent months has been maintained in such steady and important volume. Several recent cargoes of American scrap destined for Japan have been transported in Japanese vessels that have delivered Royal Dutch iron at Atlantic ports.

Valley Steel Production Declines; New Business Showing Some Gains

YOUNGSTOWN, Feb. 21—Although the steel industry in the Valleys has had a slight setback this week so far as operations are concerned, the trend of orders for finished steel products still seems to be upward, and the major producers in the district are all running slightly ahead of January in new business. Steel ingot output in the district this week will not average better than 17 per cent, because of suspension of activity at one large plant and curtailment at another. The comparatively heavy operation during the first half of the month was occasioned partly by a large pipe order booked by the Republic Steel Corp., which is being shipped this week. However, sheet mills are occupied at a somewhat higher rate than was the case earlier in the month, and bar mill activity is fairly well sustained. Tin plate units in the district continue to run at 45 to 50 per cent of capacity.

Orders for steel in the last two weeks have been extremely well diversified, and producers are encouraged by the fact that many small manufacturing consumers who have been out of the market since December have again resumed production. Buying by jobbers is not extensive, partly because of price weakness. The larger fabricators of steel products in the district are stepping up their schedules slightly, with a promise of further seasonal expansion next month. A little tankage business is coming out, but the oil industry generally is hesitant to make commitments just now. Miscellaneous demand for tubular goods is lighter and less buying for the Conroe field in Texas is reported. The automobile industry is naturally being watched with considerable interest, and evidence of curtailment in steel requirements is still lacking. In fact, expanding operations by the Ford Mo-

tor Co. may increase shipments to the Detroit territory in the near future.

Extreme declines in sheet prices since the first of the year have again focused attention upon the large losses incurred in this business, and talk is heard of rather considerable advances in price. Most consumers of sheets are now covered for the remainder of this quarter at the low prices which have prevailed recently, but an advance announced now might become effective on second quarter tonnage. Mills have established 2.60c., Pittsburgh, as a minimum price on galvanized sheets, and nothing less is reported on current orders. The market on hot-rolled annealed sheets is less clearly defined, as some mills are still meeting quotations of less than 2c., Pittsburgh. The market on light cold-rolled sheets is quotable at 2.25c. to 2.30c., but it is believed that the asking price for such material will be advanced to 2.50c. Tin mill black plate has become established at 2.30c., Pittsburgh. The hot-rolled strip market is still largely free from concessions, with the 1.45c., Pittsburgh, price quite representative. On cold-rolled strip quotations range downward from 2c., Pittsburgh or Cleveland, with most tonnage included in a \$4 spread. However, the market continues to be rather demoralized. Bar prices are well held at 1.60c., Pittsburgh, and quotations on nails and wire products are becoming established at the levels announced last week. No deviations from the \$26, Pittsburgh, price on sheet bars have been reported, and it now seems likely that adjustments between this price and sheet quotations will be made by raising the latter rather than lowering the former.

The raw material markets are very dull. Domestic coke has been active this month, but scarcely any pig iron is moving.

Fabricated Structural Steel

Awards Gain—New Projects Also in Larger Volume

BOOKINGS of 7500 tons, although including no large tonnages, are heavier than those of a week ago, when 5900 tons was reported. The greatest activity is for public work in the South and Southwest. New projects of 14,700 compare with 2500 tons in the previous week. The outstanding job is 6500 tons for a Federal building in St. Louis, for which plans have been approved. Plate lettings are again large, totaling 10,350 tons. Awards follow:

NORTH ATLANTIC STATES

Cambridge, Mass., 420 tons, police headquarters, to A. O. Wilson Structural Co.

Cambridge, Mass., 200 tons, fire station, to Boston Bridge Works, Inc.

Poughkeepsie, N. Y., 260 tons, sports building, Vassar College, to Tiffany-Diamond Co.; fabrication sublet to Belmont Iron Works.

Ithaca, N. Y., 320 tons, Biggs Memorial Hospital, to Shippers Car Line Corp.

Newark, N. J., 165 tons, building for Frank G. Shattuck Co., to A. E. Smith Co.

Newark, N. J., 150 tons, section 6, city subway, to Selbach-Meyer Co., West New York, N. J.

Warren County, Pa., 200 tons, State highway bridge, route 95, to Lehigh Structural Steel Co.

Elk County, Pa., 125 tons, State bridge, to Lackawanna Steel Construction Corp.

Bradford County, Pa., 100 tons, State bridge, to Lackawanna Steel Construction Corp.

Canonsburg, Pa., 170 tons, mill building extension for Standard Tin Plate Co., to Fort Pitt Bridge Works Co.

SOUTH AND SOUTHWEST

Roanoke, Va., 370 tons, telephone building, to Virginia Bridge & Iron Co., Inc.

Charlotte, N. C., 470 tons, post office, to Virginia Bridge & Iron Co., Inc.

Paducah, Ky., 300 tons, manufacturing building, to Virginia Bridge & Iron Co., Inc.

Fullerton, Ky., 130 tons, State highway bridge, to McClintic-Marshall Corp.

State of Kentucky, 465 tons, lock and dam No. 5 on Green River, to Stupp Brothers Bridge & Iron Co.

State of Kentucky, 450 tons, lock and dam No. 1 on Barren River, to Mississippi Valley Structural Steel Co.

Fort Worth, Tex., 240 tons, Belknap Street viaduct, to Virginia Bridge & Iron Co.; previously reported to North Texas Iron & Steel Co.

State of New Mexico, 340 tons, bridges, to American Bridge Co.

State of New Mexico, 220 tons, bridges, to Kansas City Structural Steel Co.

CENTRAL STATES

Cook County, Ill., 1550 tons, State highway bridge, to American Bridge Co.

WESTERN STATES

Vernon, Cal., 100 tons, brewery, to Pacific Iron & Steel Co.

Seattle, 100 tons, city projects, to Pacific Car & Foundry Co.

Surf, Cal., 710 tons, two bridges for Southern Pacific Railroad, to American Bridge Co.

NEW STRUCTURAL STEEL PROJECTS

NORTH ATLANTIC STATES

State of New Jersey, 885 tons, viaduct, route 29, from Pennsylvania Railroad to Empire Street, Newark; bids March 6, State Highway Commission, Trenton.

Rupert, Pa., 2500 tons, bridge over north branch of Susquehanna River for Reading Co.; bids in.

Broadhead, Pa., tonnage not given, house and machine shop for Portland Cement Co.; bids March 4.

Norristown, Pa., 200 tons, De Kalb Street bridge for Pennsylvania Railroad.

SOUTH AND SOUTHWEST

Pampas, Tex., 160 tons, post office.

Pocahontas, Ark., 150 tons, bridge.

Phoenix, Ariz., 600 tons, post office; bids to be opened March 21 by Supervising Architect, Treasury Department, Washington.

Bernalillo County, N. M., 220 tons, State highway structure; bids Feb. 28.

CENTRAL STATES

Wausau, Wis., 150 tons, post office.

Milwaukee, United States Engineer Office, 100 tons; lock gates, etc., for Kaukauna lock; Lakeside Bridge & Steel Co., low bidder.

Sheboygan, Wis., 350 tons, court house; bids about May 1.

St. Paul, 5000 tons, post office; Fleisher Engineering & Construction Co., low bidder.

State of Nebraska, 450 tons, highway bridges.

Santa Fe Railroad, 350 tons, track leveling work.

St. Louis, 6500 tons, Federal building, plans approved; Mauran, Russell & Crowell, architects.

State of Missouri, 1573 tons, highway bridges, bids for which will be opened March 4, as follows: Platte County, 450 tons; Livingston County, 100 tons; Gentry County, 130 tons; Clay County, 320 tons; Wayne County, 458 tons; Scott County, 115 tons.

Reinforcing Steel

Awards 4200 Tons—New Projects 2675 Tons

State of Illinois, 2000 tons, road slabs and bridge work, to miscellaneous bidders.

Ithaca, N. Y., 300 tons, Biggs Memorial Hospital, to E. T. Edwards Co., Columbia, Pa.

Fort Miley, Cal., 1700 tons, eleven buildings, to Gulf States Steel Co.

Rockwell Field, Cal., 200 tons, officers' quarters, to an unnamed bidder.

NEW REINFORCING BAR PROJECTS

State of New Jersey, 715 tons, viaduct, route 29, from Pennsylvania Railroad to Empire St., Newark, bids March 6, State Highway Commission, Trenton.

Nashville, Tenn., 270 tons, post office.

Cincinnati, 425 tons, interceptor sewer for city.

Sheboygan, Wis., 250 tons, court house; bids about May 1.

Pearl Harbor, T. H., 1000 tons, pier and quay walls, bids soon.

Pipe Lines

White Eagle Oil Corp., Kansas City, Mo., plans 8-in. crude oil steel pipe line from Nickel oil fields, southern part of McPherson County, Okla., to refinery at Augusta, Kan. Company is an interest of Standard Oil Co. of New York.

St. Francisville, La., has called special election on March 21 to vote bonds for \$50,000 for natural gas steel pipe lines, meter station and other facilities, including pipe line distributing system.

Santa Maria Gas Co., San Luis Obispo, Cal., plans rebuilding steel pipe line from city to Reed's Station, about eight miles. A. T. Fessler, superintendent, in charge.

New York Oil Co., Lander, Wyo., plans extensions and improvements in crude oil steel

WESTERN STATES

Visalia, Cal., 125 tons, post office, bids under advisement.

Seattle, 125 tons, river work by United States Engineering Department; bids Feb. 23.

HAWAII

Pearl Harbor, 300 tons, pier and quay walls, bids soon.

FABRICATED PLATE AWARDS

Buffalo, 750 tons, tanks for Frontier Fuel & Oil Co., to McClintic-Marshall Co.

Washington, 200 tons, standpipe on Capitol Heights, to Pittsburgh-Des Moines Steel Co.

Marcus Hook, Pa., 1200 tons, four 80,000-bbl. tanks for Sinclair Refining Co., to Chicago Bridge & Iron Works.

Paducah, Ky., 2350 tons, 10 coal barges for West Kentucky Coal Co., to Marietta Mfg. Co.

Houston, Tex., 2400 tons, eight 80,000-bbl. tanks for Sinclair Refining Co., to Chicago Bridge & Iron Works.

Fort Worth, Tex., 140 tons, tanks for Sinclair Refining Co., to Hedges, Walsh & Weldener Co.

Vicksburg, Miss., 250 tons, 40 pontoons for United States Engineers, to Mississippi Valley Structural Steel Co.

Carthage, Mo., 150 tons, 500,000-gal. elevated water tank, to R. D. Cole Mfg. Co.

Vernon, Cal., 102 tons, storage tanks, to Western Pipe & Steel Co.

Denver, 2800 tons additional, cylinder gates for Hoover Dam, to Westinghouse Electric & Mfg. Co.

NEW PROJECTS

Mobile, Ala., 190 tons, two steel barges for United States Engineers American Bridge Co., low bidder.

San Diego, 1000 tons, three 500-hp. boilers for navy, specification 7171, bids March 8.

Los Angeles County, Cal., 400 tons, two 500-hp. boilers for County hospital.

pipe line between Lander and Riverton, Wyo. Will also carry out similar program in pipe line in Sand Draw district.

Mexican Eagle Oil Co., El Plan, State of Vera Cruz, Mexico, has authorized crude oil steel pipe line from local properties to company railway line at Nachitlán, same State, about 22 miles. Company is a subsidiary of Royal Dutch Shell Syndicate, London, England.

Railroad Equipment

Pacific Fruit Express has ordered 150 freight car steel underframes from Pacific Car & Foundry Co., to be built by Western Pipe & Steel Co.

Chinese Government, Purchasing Commission, is inquiring for 24 passenger cars and underframes, and six 2-8-0 type locomotives with tenders.

Missouri Pacific has ordered air-conditioning equipment for 10 passenger cars.

Missouri-Kansas-Texas is tentatively considering purchase of four lounge cars.

Grand Trunk has ordered 40 axle bearings to be applied on 10 locomotives by Timken Roller Bearing Co.

Shipments of railroad locomotives in January were only two, both electric, and for domestic account, according to reports received by the Bureau of the Census from principal manufacturers. December shipments consisted of six electric locomotives, also for domestic use. Unfilled orders at the end of January of six electric locomotives, also for domestic use, totaled 71 locomotives, one of steam and 70 of electric type.

"Table of Arc Spectrum Lines Arranged in Order of Wave Length" is the title of a pamphlet by Welton J. Crook, professor of metallurgy, Stanford University, Cal., published by the Stanford University Press.

Non-Ferrous Metals Reflect Irregular Trends

Copper Maintains Recent Firmness; Lead Inactive—Tin Lower on Sterling Drop; Zinc Price Steadies

NEW YORK, Feb. 21—The recent firmness that has characterized the domestic copper market is still in evidence. Quite a scattering of small-lot orders, ranging from 25 to 100 tons, is reported, while some recent bookings involved relatively important tonnage. Most of the round-lot buying, however, is traced to producers' fabricating units which, in the absence of any change in the primary producers' posting of 6.25c. a lb., delivered, have satisfied their needs in the outside market. The electrolytic price is strong at 5c., Connecticut, for delivery through second quarter. Trading abroad slackened somewhat in the past week. Foreign values, however, displayed strength early in the week, fluctuating between 4.95c. and 5.15c. c.i.f. usual Continental ports. Today's prices abroad ranged from 5c. to 5.05c. Lake copper, while nominally quotable at 5c. to 5.12½c., delivered New York, is reported to have sold down to 4.90c. during the week.

Lead

January lead statistics, as was expected, were unfavorable. Production

during that month was 27,600 tons, against shipments of only 19,000 tons. The resultant increase of 8500 tons in smelters' stocks establishes a surplus of refined lead at the record high level of 184,700 tons. In the face of this unfavorable report, fresh buying has been at a minimum. Consumers are still not inclined to state their forward needs and are generally covering only spot requirements. Prices, however, are apparently resistant to the current drab market condition and are unchanged at 2.87½c., St. Louis, and 3c., New York.

Tin

A break in sterling today to \$3.41% resulted in a corresponding decline in the New York price of spot Straits to 23.45c. a lb. Prior to this reaction the price had been fairly steady, fluctuating during the week from 23.50c. to 23.60c. Buying has been encouraged by the downward revisions in price. Most trading has involved nearby delivery. Recent shrinkage in stocks of tin held in New York warehouses, however, has cre-

ated a relatively stringent situation with respect to prompt tin. Some sellers, in fact, who are short on nearby metal, find themselves compelled to restrict offerings to futures. In London, prices again showed unimportant declines for the week. Quotations there today were £148 5s. a ton for spot standard, £148 10s. for future standard, and £154 for spot Straits. Today's Singapore market, at £152 17s. 6d., scored an advance of about 10s. over the price a week ago. Withdrawals of 115 tons last week brought United Kingdom warehouse stocks down to 28,532 tons. Shipments from the East up to and including Feb. 18 totaled 3203 tons.

Zinc

Prime western zinc at the close of last week declined to 2.55c., East St. Louis, the lowest level since July 30. Bids at 2.50c. failed to find takers, and a firming attitude on the part of sellers has evidently checked further declines. Today the market is firmly established at 2.60c., East St. Louis, or 2.97c., New York, for spot and March shipment, with spreading indications that a range of five points higher will prevail at the close of trading. Current inquiry is light.

Buffalo Shipments of Pig Iron Not Gaining

BUFFALO, Feb. 21—Two or three sales of 100 to 300 tons of foundry and malleable iron for delivery over an extended period have been closed. Outside of these, only carload sales are noted. Foundry melt is very low, and it is probable that shipments in February will not be larger than in January.

Steel

Republic Steel Corp., which charged two furnaces February 11, is still operating the early part of this week, but it is not certain how long these will continue. The Lackawanna plant of Bethlehem Steel continues to operate four open-hearths and Wickwire Spencer one open-hearth. The Seneca sheet division of Bethlehem is operating at about 15 per cent. The reinforcing bars for the Biggs Memorial Hospital at Ithaca, N. Y., amounting to 300 tons have been let, as has the structural steel, amounting to 320 tons. About 750 tons of steel plate work for tanks for the Frontier Fuel & Oil Co., Buffalo, has been let. The first unit of the Rochester State hospital job, calling for 257 tons of structural steel, has been awarded. Two bridges in Pennsylvania requiring about 200 tons have been let.

Scrap

Included in recent sales were 150 tons of No. 1 machinery cast at \$9.75 and 100 tons of short rails at \$8.50. Shipments of steel scrap to local mills are being made in a small way.

The Week's Prices. Cents Per Pound for Early Delivery

	Feb. 15	Feb. 16	Feb. 17	Feb. 18	Feb. 20	Feb. 21
Electrolytic copper, N. Y.*	4.75	4.75	4.75	4.75	4.75	4.75
Lake copper, New York	5.00	5.00	5.00	5.00	5.00	5.00
Straits tin, Spot, N. Y.	23.50	23.50	23.55	...	23.60	...
Zinc, East St. Louis	2.60	2.60	2.55	2.55	2.60	2.60
Zinc, New York	2.97	2.97	2.92	2.92	2.97	2.97
Lead, St. Louis	2.87½	2.87½	2.87½	2.87½	2.87½	2.87½
Lead, New York	3.00	3.00	3.00	3.00	3.00	3.00

* Refinery quotations price ¼c. higher delivered in Connecticut.
Aluminum, 98 to 99 per cent pure, 22.90c. a lb., delivered.
Nickel electrolytic cathode, 35c. a lb., delivered; shot and ingot, 36c. a lb., delivered.
Antimony, 5.62½c. a lb., New York.
Brass ingots, 85-5-5, 5.25c. a lb., New York and Philadelphia.

From New York Warehouse

Delivered Prices, Base per Lb.	
Tin, Straits pig	25.50c. to 26.50c.
Tin, bar	27.50c. to 29.50c.
Copper, Lake	7.50c. to 8.50c.
Copper, electrolytic	7.25c. to 8.25c.
Copper, casting	7.00c. to 8.00c.
*Copper sheets, hot-rolled	13.62½c.
*High brass sheets	11.00c.
*Seamless brass tubes	13.25c.
*Seamless copper tubes	12.37½c.
Brass rods	8.50c.
Zinc, slabs	4.37½c. to 4.87½c.
Zinc sheets (No. 9), casks	9.25c. to 9.50c.
Lead, American pig	3.75c. to 4.25c.
Lead, bar	5.25c. to 6.25c.
Lead, sheets	6.75c.
Antimony, Asiatic	8.00c. to 9.00c.
Alum, virgin, 99 per cent plus	23.30c.
Alum. No. 1 for remelting, 98 to 99 per cent	16.00c.
Solder, ½ and ½	15.50c. to 16.50c.
Babbitt metal, commercial grade	21.00c. to 32.00c.

*These prices are also for delivery from Chicago and Cleveland warehouses.

From Cleveland Warehouse

Delivered Prices per Lb.	
Tin, Straits pig	27.50c.
Tin, bar	29.50c.
Copper, Lake	6.125c.

Copper, electrolytic	6.125c.
Copper, casting	5.875c.
Zinc, slab	4.25c. to 4.50c.
Lead, American pig	3.75c. to 4.00c.
Lead, bar	7.25c.
Antimony, Asiatic	8.50c.
Babbitt metal, medium grade	16.50c.
Babbitt metal, high grade	31.25c.
Solder, ½ and ½	17.00c.

Old Metals, Per Lb., New York

Buying prices are paid by dealers for miscellaneous lots from smaller accumulators, and selling prices are those charged to consumers after the metal has been prepared for their uses. (All prices are nominal.)

	Dealers' Buying Prices	Dealers' Selling Prices
Copper, hvy. crucible	3.75c.	4.375c.
Copper, hvy. and wire	3.50c.	4.25c.
Copper, light and bottoms	2.625c.	3.50c.
Brass, heavy	1.625c.	2.25c.
Brass, light	1.25c.	1.875c.
Hvy. machine composition	2.50c.	3.00c.
No. 1 yel. brass turnings	2.125c.	2.625c.
No. 1 red brass or compos. turnings	2.375c.	2.875c.
Lead, heavy	2.125c.	2.50c.
Zinc	1.25c.	1.625c.
Cast aluminum	3.75c.	5.00c.
Sheet aluminum	8.00c.	9.75c.

Prices of Finished and Semi-Finished Steel, Coke, Coal, Cast Iron Pipe

BARS, PLATES, SHAPES

Iron and Steel Bars

	<i>Base per Lb.</i>
Soft Steel	
Pittsburgh mill	.60c.
F.o.b. Chicago	.70c.
Del'd Philadelphia	.91c.
Del'd New York	.95c.
Del'd Cleveland	1.30c.
F.o.b. Detroit	1.35c.
F.o.b. Lackawanna	1.70c.
F.o.b. Birmingham	1.75c.
C.I.F. Pacific ports	2.10c.

Billet Steel Reinforcing (as quoted by distributors)

	<i>Base per Lb.</i>
F.o.b. Pittsburgh mills, 40, 50, 60-ft.	1.50c.
F.o.b. Birmingham, mill lengths	1.75c.
F.o.b. Cleveland	1.90c.

Roll Steel

	<i>Base per Lb.</i>
F.o.b. mills, east of Chicago dist.	.35c. to 1.45c.
F.o.b. Chicago Heights mills	1.50c.

Irons

	<i>Base per Lb.</i>
Common iron, f.o.b. Chicago	1.60c.
Refined iron, f.o.b. Pgh mills	2.75c.
Common iron, del'd Philadelphia	1.80c.
Common iron, del'd New York	1.90c.

Tank Plates

	<i>Base per Lb.</i>
F.o.b. Pittsburgh mill	1.60c.
F.o.b. Chicago	1.70c.
F.o.b. Birmingham	1.75c.
Del'd Cleveland	1.80c.
Del'd Philadelphia	1.895c.
F.o.b. Coatesville	1.50c. to 1.90c.
F.o.b. Sparrows Point	1.50c. to 1.70c.
F.o.b. New York	1.69c. to 1.79c.
C.I.F. Pacific ports	2.00c.
Wrought iron plates, f.o.b. Pgh	3.00c.

Structural Shapes

	<i>Base per Lb.</i>
F.o.b. Pittsburgh mill	1.60c.
F.o.b. Chicago	1.70c.
F.o.b. Birmingham	1.75c.
F.o.b. Lackawanna	1.70c.
F.o.b. Bethlehem	1.70c.
Del'd Cleveland	1.80c.
Del'd Philadelphia	1.7495c.
Del'd New York	1.86775c.
C.I.F. Pacific ports (standard)	2.10c.
C.I.F. Pacific ports (wide flange)	3.20c.

Steel Sheet Piling

	<i>Base per Lb.</i>
F.o.b. Pittsburgh	1.90c.
F.o.b. Chicago mill	2.00c.
F.o.b. Buffalo	2.00c.

Alloy Steel Bars

	<i>Base per Lb.</i>
F.o.b. Pittsburgh, Chicago, Buffalo, Massillon or Canton)	
Alloy Quality Bar Base	2.45c. to 2.65c. per Lb.

S.A.E. Series	Differential Numbers	<i>Base per 100 Lbs.</i>
2000 (1% Nickel)	0.25	\$0.25
2200 (1 1/2% Nickel)	0.55	
2300 (3 1/2% Nickel)	1.50	
2500 (5% Nickel)	2.25	
2100 Nickel Chromium	0.55	
2200 Nickel Chromium	1.35	
2300 Nickel Chromium	3.80	
2400 Nickel Chromium	3.20	
4100 Chromium Molybdenum (0.16 to 0.25 Molybdenum)	0.50	
4100 Chromium Molybdenum (0.25 to 0.40 Molybdenum)	0.70	
4000 Nickel Molybdenum (0.20 to 0.30 Molybdenum, 1.50 to 2.00 Nickel)	1.05	
5100 Chromium Steel (0.60 to 0.90 Chromium)	0.35	
5100 Chromium Steel (0.80 to 1.10 Chromium)	0.45	
5100 Chromium Spring Steel	0.20	
5100 Chromium Vanadium Bar	1.20	
4100 Chromium Vanadium Spring Steel	0.95	
9250 Silicon Manganese Spring Steel (flat)	0.25	
Round and Squares	0.50	
Chromium Nickel Vanadium	1.50	
Carbon Vanadium	0.95	

Above prices are for hot-rolled steel bars. Drawing quality. The differential for cold-drawn bars is 3% a lb. higher, with standard classification for cold-finished alloy steel bars applying. For billets 4 x 4 to 10 x 10 in., the price for a gross ton is the net price for bars of the same analysis.

Billets under 4 x 4 in. carry the steel per base. Slabs with a section area of 16 in. or over carry the billet price. Slabs with sectional area of less than 16 in. or less than 2 1/2 in. thick, regardless of sectional area, take the bar price.

Cold Finished Bars*

	<i>Base per Lb.</i>
Bars, f.o.b. Pittsburgh mill	1.70c.
Bars, f.o.b. Chicago	1.75c.
Bars, Cleveland	1.75c.
Bars, Buffalo	1.75c.
Bars, Detroit	1.90c.
Bars, eastern Michigan	1.95c.
Shafting, ground, f.o.b. mill	

1 1/4 in. 3.00c.

1 3/8 to 1 1/2 in. 2.50c.

1 9/16 to 1 1/2 in. 2.35c.

1 15/16 to 2 1/2 in. 2.20c.

2 1/8 to 6 in. 2.05c.

* In quantities of 10,000 to 10,000 lb.

SHEETS, STRIP, TIN PLATE, TERNE PLATE

Sheets

Hot-Rolled

No. 10, f.o.b. Pittsburgh	1.45c. to 1.50c.
No. 10, f.o.b. Chicago	1.55c.
No. 10, f.o.b. Philadelphia	1.70c. to 1.81c.
No. 10, f.o.b. Birmingham	1.80c. to 1.85c.

Hot-Rolled Annealed

No. 10, Pittsburgh	1.60c. to 1.70c.
No. 10, Chicago	1.70c.
No. 10, Birmingham	1.80c.
No. 10, c.i.f. Pacific Coast ports	2.17 1/2c.

Hot-Rolled Assisted

No. 10, Pittsburgh	2.00c.
No. 24, f.o.b. Chi'c mills	2.00c. to 2.10c.
No. 24, del'd Philadelphia	2.31c.
No. 24, f.o.b. Birmingham	2.15c.
No. 24, c.i.f. Pacific Coast ports	2.85c.

Hot-Rolled Assisted

No. 24, f.o.b. Pittsburgh	2.00c.
No. 24, f.o.b. Chi'c mills	2.00c. to 2.10c.
No. 24, del'd Philadelphia	2.31c.
No. 24, f.o.b. Birmingham	2.15c.
No. 24, c.i.f. Pacific Coast ports	2.85c.

Heavy Cold-Rolled

No. 10 gage, f.o.b. Pittsburgh	1.85c. to 1.95c.
No. 10 gage, f.o.b. Chicago mills	1.95c. to 2.05c.
No. 10 gage, del'd Philadelphia	2.15c. to 2.25c.

Light Cold-Rolled

No. 20 gage, f.o.b. Pittsburgh	2.25c. to 2.30c.
No. 20 gage, f.o.b. Chicago mills	2.40c. to 2.50c.
No. 20 gage, del'd Philadelphia	2.61c. to 2.71c.

Note: Automobile body stock and steel furniture sheets to be quoted henceforth on cold-rolled sheet base prices, with extras for drawing quality.

Galvanized Sheets

No. 24, f.o.b. Pittsburgh	2.50c. to 2.60c.
No. 24, f.o.b. Chicago mills	2.50c.
No. 24, del'd Philadelphia	2.81c. to 2.91c.
No. 24, f.o.b. Birmingham	2.60c.
No. 24, c.i.f. Pacific Coast ports	3.35c. to 3.50c.

Long Termes

No. 24, unassorted, 8-lb. coating, f.o.b. Pittsburgh	2.60c. to 2.70c.
No. 24, f.o.b. Pittsburgh	2.40c. to 2.50c.
No. 20, f.o.b. Pittsburgh	2.90c. to 3.00c.

Vibrous Endmills Stock

No. 28, f.o.b. Pittsburgh	2.30c.
No. 28, Chicago mill	2.40c.

Tin Plate

(F.o.b. Myronstown or Pittsburgh)	(Per Package, 20 x 28 in.)
8-lb. coating L.C.	\$9.50
15-lb. coating L.C.	12.00
20-lb. coating L.C.	13.00
25-lb. coating L.C.	14.10
30-lb. coating L.C.	14.90
40-lb. coating L.C.	16.70

Hot-Rolled Hoops, Bands, Strips and Flats under 1/4 in.

	<i>Base per Lb.</i>
F.o.b. Pittsburgh	1.80c. to 2.00c.
F.o.b. Cleveland	1.80c. to 2.00c.
F.o.b. Chicago	2.20c. to 2.30c.
F.o.b. Worcester	2.00c. to 2.10c.
Fender stock, No. 20, gage, Pittsburgh or Cleveland	2.55c. to 2.65c.

Wire Products

(Carload lots, f.o.b. Pittsburgh and Cleveland.)

Extras of 10c a 100 lb. on mixed and joint carloads, 20c. on pool carloads and 30c. on less than carloads are applied on all merchant wire products. In carloads and mixed carloads a discount of 10 per cent on extras is allowed.

To Manufacturing Trade

Bright wire 2.10c.

Spring wire 3.00c.

To Jobbing Trade

	<i>Base per Keg</i>
Standard wire nails</td	

Skelp	
(F.o.b. Pittsburgh or Youngstown)	
Grooved	Per Lb.
Universal	1.80c.
Sheared	1.60c.

Wire Rods	
(Common soft, base)	
Pittsburgh	Per Gross Ton
Cleveland	35.00
Chicago	36.00

COKE, COAL AND FUEL OIL

Coke	
Per Net Ton	
Furnace, f.o.b. Connellsville	
Prompt	\$1.75 to \$2.00
Foundry, f.o.b. Connellsville	
Prompt	2.50 to 4.25
Foundry, by-product, Chicago	
ovens, for delivery outside switching districts	7.00
Foundry, by-product, delivered in Chicago switching districts	7.75
Foundry, by-product, New England, delivered	10.00
Foundry, by-product, Newark on Jersey City, del'd	8.20 to 8.81
Foundry, by-product, Phila.	8.50
Foundry, by-product, Cleveland, delivered	7.82
Foundry, Birmingham	5.00
Foundry, by-products, St. Louis, f.o.b. ovens	8.00
Foundry, by-products, del'd St. Louis	9.00

Coal

Coal	
Per Net Ton	
Mine run steam coal, f.o.b. W. Pa. mines	\$1.00 to \$1.15
Mine run coking coal, f.o.b. W. Pa.	1.10 to 1.25
Gas coal, % in., f.o.b. Pa. mines	1.25 to 1.40
Mine run gas coal, f.o.b. Pa. mines	1.20 to 1.30
Steam slack, f.o.b. W. Pa. mines	0.25 to 0.35
Gas slack, f.o.b. W. Pa. mines	0.35 to 0.45

Fuel Oil

Per Gal. f.o.b. Bayonne, N. J.	
No. 3 distillate	4.00c.
No. 4 industrial	3.50c.
Per Gal. f.o.b. Baltimore	
No. 3 distillate	4.00c.
No. 4 industrial	3.50c.

Per Gal. del'd Chicago

No. 2 industrial fuel oil	
2.80c. to 2.90c.	
2.45c. to 2.50c.	

Per Gal. f.o.b. Cleveland

No. 3 distillate	
5.25c.	
4.75c.	

REFRACTORIES

Fire Clay Brick	
Per 1000 f.o.b. Works	
High-heat, Intermediate Duty Brick	Duty Brick
Penn.	\$35.00
Maryland	\$25.00 to \$30.00
New Jer.	\$44.00 to 57.00
Ohio	35.00
Kentucky	35.00
Missouri	35.00
Illinois	35.00
Ground fire clay, per ton	6.50

Chrome Brick

Standard size	
Per Net Ton	
Standard size	
Pennsylvania	\$38.00
Chicago	47.00
Birmingham	50.00
Silica clay, per ton	8.00

Silica Brick

Per 1000 f.o.b. Works	
High-heat, Intermediate Duty Brick	Duty Brick
Penn.	\$35.00
Maryland	\$25.00 to \$30.00
New Jer.	\$44.00 to 57.00
Ohio	35.00
Kentucky	35.00
Missouri	35.00
Illinois	35.00
Ground fire clay, per ton	6.50

Magnesite Brick

Standard sizes, burned, f.o.b. Balt.	
more and Chester, Pa.	\$61.50
Unburned, f.o.b. Baltimore	52.00
Grain magnesite, f.o.b. Baltimore and Chester, Pa.	38.50
Domestic, f.o.b. Chewelah, Wash.	20.90

CAST IRON PIPE

Per Net Ton	
6-in. and larger, del'd Chicago	\$41.10
4-in. del'd Chicago	44.40
6-in. and larger, del'd N. York	38.30
4-in. del'd New York	32.00
6-in. and larger, Birmingham	36.00
4-in. Birmingham	36.00

Class "A" and gas pipe, \$3 extra.

Pig Iron, Ores, Ferroalloys

VALLEY

Per Gross ton, f.o.b. Valley furnace:	
Basic	\$13.50
Bessemer	15.00
Gray Forge	14.50
No. 2 foundry	14.50
No. 3 foundry	14.00
Malleable	\$14.50 to 15.00
Low phos., copper free	23.00 to 24.00

Freight rate to Pittsburgh or Cleveland district, \$1.89.

PITTSBURGH

Per Gross ton, f.o.b. Pittsburgh district furnace:	
Basic	\$14.00
No. 2 foundry	15.00
No. 3 foundry	14.50
Malleable	15.00
Bessemer	15.00

Freight rates to points in Pittsburgh district range from 89c. to \$1.26.

CHICAGO

Per gross ton at Chicago furnace:	
N'th'n No. 2 fdy.	\$15.50
N'th'n No. 1 fdy.	16.00
Malleable, not over 2.26 sll.	15.50
High phosphorus	15.50
Lake Super. charcoal, sll. 1.50, by rail	23.17
Southern No. 2 fdy.	16.14
Low phos., sll. 1 to 2, Copper free	23.00
Silvery, sll. 8 per cent.	23.67
Bess. ferrosil., 15 per cent.	28.92

Prices are delivered consumers' yards except on Northern foundry, high phosphorus and malleable, which are f.o.b. local furnaces, not including a switching charge.

ST. LOUIS

Per gross ton at St. Louis:	
No. 2 fdy., sll. 1.75 to 2.25	f.o.b. Granite City, Ill.
Malleable, f.o.b. Granite City	\$17.50
Northern No. 2 fdy., del'd	St. Louis
St. Louis	\$17.80 to 18.30
Southern No. 2 fdy., del'd	14.50
Northern malleable, del'd	17.80 to 18.30
Northern basic, del'd	17.80 to 18.30

Freight rates: 83c. (average) Granite City to St. Louis; \$2.30 from Chicago; \$4.56 from Birmingham.

NEW YORK

Per gross ton, delivered New York district:	
Buffalo, No. 2, del'd east	\$17.66
N. J.	\$17.41 to \$17.66
East Pa. No. 2 fdy.	14.02
East Pa. No. 2X fdy.	14.52

Freight rates: \$1.52 to \$2.63 from eastern Pennsylvania.

* Prices delivered to New Jersey cities having rate of \$3.41 a ton from Buffalo.

BUFFALO

Per gross ton, f.o.b. furnace:	
No. 1 fdy.	\$16.00
No. 2X fdy.	16.50
No. 1 fdy.	17.50
Malleable, sll. up to 2.25	16.50

Freight rates: \$1.52 to \$2.63 from eastern Pennsylvania.

CINCINNATI

Per gross ton, delivered Cincinnati:	
Ala. fdy., sll. 1.75 to 2.25	\$13.82
Ala. fdy., sll. 2.25 to 2.75	14.32
Tenn. fdy., sll. 1.75 to 2.25	13.82
N'th'n No. 2 foundry	\$17.01 to 17.50
S'h'n Ohio silvery, 8%	21.02

Freight rates: \$2.02 from Ironon and Jackson, Ohio; \$2.22 from Birmingham.

CLEVELAND

Per gross ton at Cleveland furnace:	
N'th'n No. 2 fdy. (local delivery)	\$15.00
S'h'n fdy. sll. 1.75 to 2.25	16.14
Malleable (local delivery)	15.00
Basic (del'd east, Pa.)	14.00

Prices are f.o.b. furnace except on Southern foundry and silvery iron.

Freight rates: 83c. average local switching charge; \$3.12 from Jackson, Ohio; \$6.14 from Birmingham.

PHILADELPHIA

Per gross ton at Philadelphia:	
East. Pa. No. 2	\$13.34 to \$13.84
East. Pa. No. 2X	13.84 to 14.34
East. Pa. No. 1X	14.34 to 14.84
Malleable (del'd east, Pa.)	14.74 to 18.04

Stand. low phos. (f.o.b. furnace) 20.00 to 21.00

Cop. b'r's low phos. (f.o.b. furnace) 20.00 to 21.00

No. 2 busheling	\$2.00 to \$2.50
Locomotive tires, smooth	7.50 to 8.50
Pipe and flues	1.00 to 1.75
No. 1 machinery cast	6.25 to 6.75
Clean automobile cast	7.25 to 7.75
No. 1 railroad east	5.75 to 6.25
No. 1 agricultural cast	5.75 to 6.25
Stove plate	5.50 to 6.00
Grate bars	6.25 to 6.75
Brake shoes	6.00 to 6.50

* Relaying rails, including angle bars to match, are quoted f.o.b. dealers' yards.

PHILADELPHIA

Per gross ton delivered consumers' yards:	
No. 1 heavy melting steel	\$6.50 to \$7.00
No. 2 heavy melting steel	5.00 to 5.50
No. 1 railroad wrought	7.50 to 8.00
Bundled sheets	4.00 to 4.50
Hydraulic compressed, new	5.50 to 6.00
Hydraulic compressed, old	4.00 to 4.50
Machine shop turnings	3.50 to 4.00
Heavy axle turnings	5.50 to 6.00
Cast borings	3.50 to 3.75
Heavy breakable cast	8.00
Stove plate (steel works)	5.50 to 6.00
No. 1 low phos. heavy	10.00 to 10.50
Couplers and knuckles	8.00 to 8.50
Rolled steel wheels	5.00 to 8.50
No. 1 blast furnace	3.50 to 3.75
Spec. iron and steel pipe	6.50 to 7.00
Shafting	12.00 to 13.00
Steel axles	12.00 to 13.00
No. 1 forge fire	5.50 to 6.00
Cast iron carwheels	8.00 to 8.50
No. 1 cast	8.00 to 9.00
Cast borings (cement)	8.00 to 10.00
Steel rails for rolling	8.00 to 9.50

CLEVELAND

Per gross ton delivered consumers' yards:	
No. 1 heavy melting steel	\$7.00 to \$7.25
No. 2 heavy melting steel	6.25 to 6.50
Compressed sheet steel	6.00 to 6.50
Light bundled sheet stampings	4.00 to 4.50
Drop forge shaftings	5.25 to 5.75
Machine shop turnings	4.00 to 4.25
Short shoveling turnings	4.00 to 4.25
No. 1 busheling	5.25 to 5.50
Steel axle turnings	5.00 to 5.50
Low phos. billet crops	10.00 to 11.00
Cast iron borings and short turnings	4.50 to 5.00
Mixed borings and short turnings	4.50 to 5.00
No. 2 busheling	5.00 to 5.50
No. 1 cast	7.00 to 7.50
Railroad grate bars	5.00 to 5.50
Stove plate	5.00 to 5.50
Rails under 3 ft.	8.50 to 9.00
Rails for rolling	8.50 to 9.00
Railroad malleable	6.75 to 7.00
Cast iron carwheels	8.00

BUFFALO

Per gross ton, f.o.b. Buffalo consumers' plants:	
No. 1 heavy melting steel	\$7.00 to \$7.25
No. 2 heavy melting scrap	5.50 to 6.00
Scrap rails	6.00 to 6.50
New hydraulic comp. sheets	5.50 to 6.00
Old hydraulic comp. sheets	5.00
Drop forge shaftings	5.50 to 6.00
No. 1 busheling	5.50 to 6.00
Hvy. steel axle turnings	6.00 to 6.50
Machine shop turnings	4.00 to 4.50
Knockers and couplers	8.00
Coll and leaf springs	9.00
Rolled steel wheels	9.00
Low phos. billet crops	9.00 to 9.50
Short shov. steel turnings	5.50 to 6.00
Short mixed borings and turnings	3.75 to 4.25
Cast iron borings	3.75 to 4.25
No. 2 busheling	3.50 to 4.00
Steel car axles	10.00 to 11.00
Iron axles	10.00 to 11.00
No. 1 machinery cast	9.50 to 10.00
No. 1 cupola cast	8.50 to 9.00
Stove plate	7.00 to 7.50
Steel rails, 3 ft. and under	8.50 to 9.00
Cast iron carwheels	9.00 to 9.50
Industrial malleable	7.00 to 7.50
Railroad malleable	7.00 to 7.50
Chemical borings	7.50 to 8.00

BIRMINGHAM

Per gross ton delivered consumers' yards:	
Heavy melting steel	\$7.50 to \$8.00
Scrap steel rails	7.50 to 8.00
Short shoveling turnings	4.00 to 4.50
Stove plate	6.00 to 6.50
Steel axles	9.00
Iron axles	9.00
No. 1 railroad wrought	4.50 to 5.00
Rails for rolling	8.00 to 8.50
No. 1 cast	8.50
Tramcar wheels	8.50
Cast iron borings, chem.	8.50

ST. LOUIS

Per gross ton delivered consumers' yards:	
No. 1 heavy melting steel	\$5.50 to \$6.00
Scrap steel rails	7.50 to 8.00
Short shoveling turnings	4.00 to 4.50
Stove plate	6.00 to 6.50
Steel axles	9.00
Iron axles	9.00
No. 1 railroad wrought	4.50 to 5.00
Rails for rolling	8.00 to 8.50
No. 1 cast	8.50
Tramcar wheels	8.50
Cast iron borings, chem.	8.50

DETROIT

Per gross ton delivered consumers' yards:	
No. 1 heavy melting	4.50 to 5.00
No. 2 heavy melting	4.75 to 5.25
No. 1 locomotive tires	5.75 to 6.00
Misc. stand-up rails	5.50 to 6.00
Railroad springs	6.00 to 6.50
Bundled sheets	3.00 to 2.50
No. 2 railroad wrought	5.00 to 5.50
No. 1 busheling	3.50 to 4.00
Cast iron borings and shoveling turnings	2.75 to 3.25
Rails for rolling	6.75 to 7.25
Heavy turnings	2.00 to 2.50
Steel car axles	8.50 to 9.00
Iron car axles	11.00 to 11.50
No. 1 railroad wrought	5.50 to 6.00
Stove plate	6.00 to 6.50
Steel angle bars	6.00 to 6.50
No. 1 machinery cast	6.50 to 7.00
No. 1 railroad cast	6.25 to 6.75
Brake shoes	6.00 to 6.50
Relaying rails, 60 lb. and over	16.00 to 16.50

Relay, rails, 60 lb. and over	\$20.00 to \$21.00
Agricult. malleable	4.00 to 4.50

BOSTON

Dealer's buying prices per gross ton:	
No. 1 heavy melting steel	\$3.00 to \$3.25
Scrap T rails	2.50 to 2.75
Machine shop turnings	0.80 to 1.00
Cast iron borings	1.00
Bundled skeleton, long	2.00 to 2.25
Forge turnings	3.00 to 3.50
Blast furnace scrap	1.90 to 1.00
Forge scrap	0.90 to 1.25
Shafting	9.50 to 10.00
Steel car axles	9.00 to 9.50
Wrought pipe	4.00 to 4.25
Rails for rolling	4.50 to 5.00
Cast iron borings, chemical	7.00 to 7.25
Textile cast	\$7.00 to \$7.50
No. 1 machinery cast	7.50 to 8.00
RAILROAD malleable	8.00 to 8.50

NEW YORK

Dealers' buying prices per gross ton:	
No. 1 heavy melting steel	\$3.50 to \$3.75
No. 2 heavy melting steel	3.50 to 4.00
Machine shop turnings	1.50
Cast iron borings	1.25
Hoofed skeleton, long	2.00 to 2.25
Forge turnings	3.00 to 3.50
Blast furnace scrap	1.90 to 1.00
Forge scrap	0.90 to 1.25
Shafting	9.50 to 10.00
Steel car axles	9.00 to 9.50
Wrought pipe	4.00 to 4.25
Rails for rolling	4.50 to 5.00
Cast iron borings, chemical	7.00 to 7.25
Textile cast	\$7.00 to \$7.50
No. 1 machinery cast	7.50 to 8.00
RAILROAD malleable	8.00 to 8.50

PHILADELPHIA

Dealers' buying prices per gross ton:	
No. 1 heavy melting steel	\$3.50 to \$3.75
No. 2 heavy melting steel	3.50 to 4.00
Machine shop turnings	1.50
Cast iron borings	1.25
Hoofed skeleton, long	2.00 to 2.25
Forge turnings	3.00 to 3.50
Blast furnace scrap	1.90 to 1.00
Forge scrap	0.90 to 1.25
Shafting	9.50 to 10.00
Steel car axles	9.00 to 9.50
Wrought pipe	4.00 to 4.25
Rails for rolling	4.50 to 5.00
Cast iron borings, chemical	7.00 to 7.25
Textile cast	\$7.00 to \$7.50
No. 1 machinery cast	7.50 to 8.00
RAILROAD malleable	8.00 to 8.50

PITTSBURGH

Plates	Base per Lb.
Structural shapes	2.85c.
Soft steel bars and small shapes	2.85c.
Reinforcing steel bars	2.80c.
Cold-finished and screw stock	2.80c.
Rounds and hexagons	2.95c.
Squares and flats	3.45c.
Hoops and bands, under 4 in.	2.95c.
Hot-rolled annealed sheets (No. 24)	2.95c.
25 or more bundles	3.10c.
Galv. sheets (No. 24), 25 or more bundles	3.10c.
Hot-rolled sheets (No. 10)	2.65c.
Galv. corrug. sheets (No. 28), per square (less than 3750 lb.)	\$3.61
Spikes, large	2.40c.
Boat	2.65c.
Track bolts, all sizes, per 100 count, 70 per cent off list	2.90c.
Machine bolts, 100 count, 70 per cent off list	2.90c.
Carriage bolts, 100 count, 70 per cent off list	2.90c.
Nuts, all styles, 100 count, 70 per cent off list	2.90c.
Large rivets, base per 100 lb., 70 per cent off list	2.90c.
Wire, black, soft ann'l'd bars	2.65c.
Wire, galv. soft, base per 100 lb.	3.10c.
Common wire nails, per kg.	2.20c.
Cement coated nails, per kg.	2.20c.
On plates, structural, bars, bands, shafting, etc., applied to orders of 400 to 900 lb.	2.90c.

CHICAGO

Plates and structural shapes	Base per Lb.
Soft steel bars	2.85c.
Reinforcing bars	2.85c.
Cold-finished and screw stock	2.85c.
Rounds and hexagons	2.95c.
Hoops and bands	2.95c.
Galv. sheets (No. 24)	2.95c.
Hot-rolled sheets (No. 10)	2.65c.
Galv. corrug. sheets (No. 28)	4.05c.
Structural rivets	4.00c.
Boat rivets	4.00c.
Track bolts	2.90c.
Machine bolts	2.90c.
Carriage bolts	2.90c.
Lag screws	2.90c.
Hot-pressed nuts, sq., blank or tapped, 200 lb. or more	2.90c.
Hot-pressed nuts, hex., blank or tapped, 200 lb. or more	2.90c.
Less than 200 lb.	2.90c.
Plates and struc. shapes	2.45c.
Structural shapes	2.45c.
Soft steel bars, small shapes, iron bars (except bands)	2.45c.
Reinforced steel bars, sq., twisted and deform.	2.30c.
Cold-finished steel bars	2.35c.
2" galv. hoops	3.00c.
Structural rivets, No. 12 ga. incl.	4.00c.
Hoops, No. 14 ga. and lighter	4.00c.
Half rounds, hf. ovals, ovals and bevels	4.00c.
Tire steel, rd. edge 1/4 x 1/4 in.	4.00c.
Smaller sizes	4.75c.
Cold-finished rounds and hexagons	5.00c.
Cold-finished strip and squares	5.00c.
Cold-finished squares and flats	5.00c.
Blue annealed sheets No. 10 ga.	5.15c.
One pass cold-rolled sheets No. 24 ga.	5.15c.

PHILADELPHIA

Plates and struc. shapes	Base per Lb.
Soft steel bars	2.85c.
Reinforcing bars	2.85c.
Cold-finished and screw stock	2.85c.
Rounds and hexagons	2.95c.
Hoops and bands	2.95c.
Galv. sheets (No. 24)	2.95c.

Widening Scope of Aluminum Permanent Mold Castings

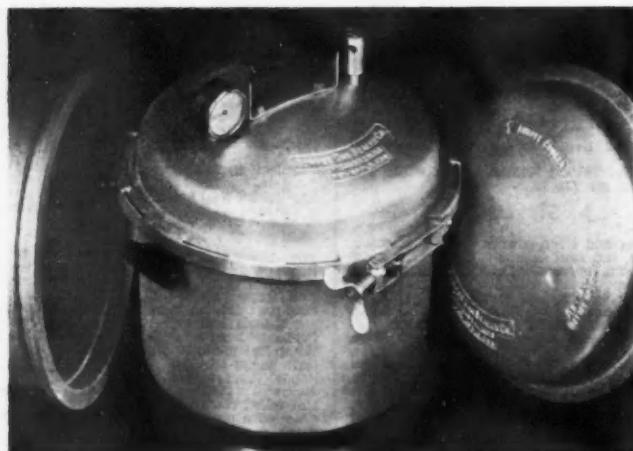
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cast aluminum alloy vessel and lid with a single screw steel clamp locking device. A gage and safety valve are inserted in the lid and non-heating conducting handles bolted to the side and lid to complete the fabricating operations after the castings have been buffed and polished. This type of cooker is designed to operate at a maximum pressure of 25 lb. per sq. in. but is tested at a pressure of 40 lb. per sq. in.

Like the pressure cooker, the ham press is fabricated almost entirely from aluminum permanent mold castings. The pressure plate is attached to the cross arm by means of nickel-

sulted in a substantial reduction in machining and assembly costs. The only machining operation on the castings involved is that required to apply the steel hinge pins at each end of the pressure plate. Since the ham presses are intended for commercial use only, there is no necessity for polishing the castings as the permanent mold cast finish is sufficiently smooth. This type of ham press is especially constructed for vertical stacking, thus making possible the use of more presses in the cooking boxes.

The semi-permanent mold process is designed for the casting of cored



plated steel bolts held in machined steel nuts cast as inserts in the pressure plate. A catch at each end of the cross arm, with nickel-plated steel pins cast as inserts, is designed to fit into the undershot teeth which are cast in the reinforced base. Pressure is secured by means of four steel springs between the pressure plate and the cross arm.

Skillful adaptation of the permanent mold process in the design and construction of the ham press has re-

parts in which a metal core can not be easily drawn or collapsed. In a vacuum cleaner nozzle with integral fan housing, for example, the housing generally has an undercut surface. Such a construction may be better adapted to sand casting; yet the superior surface finish, strength and frequently low cost of the permanent mold casting are often desired. The advantages of the two processes, therefore, are combined in the semi-permanent mold process.

PROPERTIES OF ALUMINUM PERMANENT MOLD ALLOYS¹

Alloy ²	Copper	Iron	Silicon	Zinc	Magnesium	Minimum Ultimate Strength, Lb. per Sq. In.	Minimum Elongation, Per Cent in 2 In.	Brinell ³ Hardness
43	..	..	5.0	..	..	21,000	2.5	45-55
A-108	4.5	..	5.5	..	..	24,000	0.5	65-80
113	7.5	1.2	1.5	1.5	..	24,000	0.5	70-90
122-T552*	10.0	1.2	..	..	0.2	27,000	0.0	100-125
B-195-A4*	4.5	..	2.8	..	..	33,000	4.5	70-90

NOTES:

¹ Properties obtained from standard $\frac{1}{4}$ -in. diameter test specimens, individually cast in a permanent mold, and tested without machining off the surface.

² The alloy numbers referred to are those of Aluminum Co. of America. An asterisk (*) follows the heat-treated alloys.

³ Brinell hardness limits are for tests on castings produced.

⁴ Young's modulus of elasticity for all of the above alloys is approximately 10,000,000 lb. per sq. in.



Dimensional accuracy and smooth surfaces are essential in the base casting for automobile windshields.

Southern Pacific Asks For \$1,200,000 Loan

WASHINGTON, Feb. 21—Application was made today by the Southern Pacific Railroad to the Reconstruction Finance Corporation for a work loan of \$1,200,000 for the construction of a passenger station at Houston, Tex. Approval of the loan must first be obtained from the Interstate Commerce Commission.

The Interstate Commerce Commission today approved a Reconstruction Finance Corporation loan of \$900,000 to the Chesapeake Beach Railroad to be used for extending its loan and constructing two ferry boats and terminals.

Imports and Exports of Iron and Steel Decline

WASHINGTON, Feb. 21—Declining 7498 gross tons, imports of iron and steel in January totaled 21,892 tons compared with 29,390 tons in December. Pig iron imports declined to 6444 tons from 14,244 tons. Incoming January shipments of pig iron consisted chiefly of 3209 tons from India and 2069 tons from the Netherlands. Ferromanganese imports in January rose to 3556 tons; Norway supplied 2284 tons and Canada 1162 tons. Imports of structural shapes dropped to 1673 tons in January from 4166 tons in December.

Colorado Fuel & Iron Co. has re-called 2100 workers with the reopening of its rail mill. The schedule, as now planned, will extend over a period of six weeks on the order placed by the Santa Fe. Nine hundred men have been called to work at the Sun-rise, Wyo., iron mines.

Large Surplus of Freight Equipment, Says L.F. Loree

WASHINGTON, Feb. 21—The railroads have a great surplus of freight equipment, owning 2,200,000 cars, of which 646,733 were reported idle on Dec. 31. Many could be rebuilt to advantage, while the lighter capacity cars and those of inferior construction might be torn down.

L. F. Loree, president, Delaware & Hudson Railroad, pointed out the fore-going in detailing conditions facing the carriers and proposing widespread legislative remedies in the course of testimony last Saturday before the Senate Committee on Finance in connection with hearings on the causes and cures of the commercial depression.

Mr. Loree said that if a remedy is sought it is necessary to point (1) to the excessively restrictive control imposed by the National and State Governments; (2) similar restrictions by the pressure of union labor organizations; and (3) fundamental and radical mechanical and economic changes that must, even in normal times, materially modify and divert demand, supply and means of transportation. Amplifying these major suggestions,

Mr. Loree enumerated a long list of steps that he said must be taken if railroads are to get necessary relief. Among them were: Adjustment of taxes, wages and working conditions; elimination of waste through the abandonment of unused service, obsolete facilities and mileage no longer justified by the traffic; development of the essential railroad facilities to the highest state of efficiency through the improvement of grades, reduction of curves, shortening of lines, application of heavier rail and ballast, strengthening of bridges and improvement in equipment. Numerous suggestions for changes in recasting activities of the Interstate Commerce Commission also were made.

Engineering Groups Will Meet at Chicago Fair

A conference of engineers, representing many national engineering societies, is being sponsored for "Engineering Week," June 25 to 30, by the Century of Progress Exposition at Chicago. Engineers of the iron and steel industry will be identified particularly with the meetings of American Society of Testing Materials,

American Foundrymen's Association, American Welding Society, American Institute of Mining and Metallurgical Engineers, and American Society of Mechanical Engineers. The application of new alloys and welding to the manufacture of power equipment will feature an exhibition at the Midwestern Engineering and Power Exposition, which will be held concurrently with "Engineering Week."

Sheet Output Gained Moderately in January

Production and shipments of steel sheets in January showed a moderate increase over December, according to the monthly report of the National Association of Flat Rolled Steel Manufacturers, composed of independent makers. However, sales fell off slightly and the unfilled tonnage on Feb. 1 was less than at the end of the previous month. Sales in January were 75,615 tons against 76,962 tons in December. Production was 85,337 tons against 77,489 tons during the previous month, and shipments were 79,234 tons, as against 67,412 tons in December. The January report and comparison in net tons follow:

	Jan.	Dec.	Nov.
Sales	75,615	76,962	66,274
Production	85,337	77,489	90,679
Shipments	79,234	67,412	76,866
Unfilled orders	77,509	84,390	77,339
Unshipped orders ..	39,952	37,245	43,144
Unsold stocks	54,831	57,413	60,177
Capacity per month	550,000	550,000	550,000
Percentage reporting	60.0	62.2	62.2

Percentages, Based on Capacity

Sales	22.9	22.5	19.4
Production	25.9	22.7	26.6
Shipments	24.0	19.7	22.5
Unfilled orders	23.5	24.7	22.7
Unshipped orders ..	12.1	10.9	12.6
Unsold stocks	16.6	16.8	17.6

U. S. Steel Offers Stock To Employees at \$27

Under the stock subscription plan of the United States Steel Corp., it is now offering to its employees and those of its subsidiaries, the privilege of subscribing to 200,000 shares of its common stock at \$27 per share.

Cast Iron Pipe

Gloucester, Mass., is inquiring for 6000 ft. of 8-in., 2000 ft. of 10-in., and 600 ft. of 20-in.

Lowell Iron & Steel Co., Lowell, Mass., has placed 110 tons of 6- and 8-in. with Warren Foundry & Pipe Corp.

Medford, Mass., has closed bids on 400 lengths of 6-in. and 50 lengths of 10-in.; Warren Foundry & Pipe Corp. is low bidder.

Bellingham, Wash., will take bids soon on 20,000 ft., costing about \$21,300 (size not given).

Los Angeles opened bids Feb. 21 on 3323 tons of 8-in., class 250.

Soledad, Cal., has awarded contract for 197 tons of 2 to 8 in. to Pacific State Cast Iron Pipe Co.

San Francisco will take bids Feb. 27 on 1400 tons of 16-in.

Livermore, Cal., will take bids March 9 on 125 tons of 8-in., class 150, for Veterans' Hospital.

San Bruno, Cal., will take bids March 1 on 210 tons of 4 to 8-in.

PLANT EXPANSION AND EQUIPMENT BUYING

◀ NORTH ATLANTIC ▶

Wheel Parts & Mfg. Co., 148 Thirty-ninth Street, Brooklyn, manufacturer of automobile wheels, parts, etc., has leased about 8000 sq. ft. in new Port of New York Authority building for new plant.

Signal Supply Officer, Army Base, Brooklyn, asks bids until March 3 for 150 wave meters (Circular 60); until March 6, 30 to 55 miles one-conductor submarine mine cable (Circular 59).

Kings Brewery, Inc., operating former plant of Excelsior Brewery, 227-81 Pulaski Street, Brooklyn, has plans for extensions and improvements in bottling plant as part of general modernization and expansion program. Cost of entire project close to \$1,000,000 with equipment. Shampan & Shampan, 188 Montague Street, are architects.

Ross Brass Works, Inc., New York, recently organized, has leased 7500 sq. ft. in building at 105 East Ninety-first Street for new plant.

Long Island Iron Works, Inc., Long Island City, has been organized by M. A. Feuer, 34-09 Broadway, and others, to manufacture iron and other metal products, including castings.

Continental Can Co., 1 Pershing Square, New York, has let general contract to Austin Co. of California, Inc., Los Angeles, for two-story storage and distributing plant and factory branch at San Jose, Cal., 104 x 175 ft. Cost over \$70,000 with equipment.

Star Lighting Fixture Co., 708 Broadway, New York, manufacturer of electric lighting fixtures, etc., has leased floor in building at 105-69 Spring Street, for new plant.

Trinity Bag & Paper Co., 23 West Forty-third Street, New York, manufacturer of paper bag, containers, etc., has awarded general contract to W. C. Salley, Monroe, La., for one-story mill on property recently leased from Brown Paper Mill Co., Monroe, for establishment of main plant. Present works at Brooklyn, N. Y., will be removed to Monroe, with installation of additional machinery for large increase in output. Cost about \$75,000 with equipment.

Public Works Officer, Navy Yard, New York, asks bids until March 1 for addition to building No. 4 (Specification 7194), one steel coal storage hopper (Specification 7144), repairs to air compressor (Specification 7239); until March 8, switchboard and rearrangement of power plant (Specification 7240), one 5-ton electric traveling crane for building No. 4 (Specification 7197).

Quick-Edge Mfg. Corp., Bronx, New York, has been organized by John H. Radlein, 3534 Tryon Avenue, and Harry Witzleben, 2380 Creston Avenue, to manufacture equipment and devices for sharpening tools, knives and other edge products.

Bureau of Supplies and Accounts, Navy Department, Washington, asks bids until Feb. 28 for four motor-driven milling machines (Schedule 9620), one electric box type furnace for heat treatment of alloy steel aircraft fittings, etc., and four carburizing containers (Schedule 9627) for New York Navy Yard.

Alexander Traud & Sons, Newark, N. J., have been organized by Alexander F. Traud, Newark, and William A. Traud, Irvington, N. J., capital \$100,000, to manufacture steel products. Company will take over concern of same name at 124 Polk Street, general machinists.

Atlas Specialty Co., East Newark, N. J., recently organized to manufacture electrical equipment and parts, has leased 20,000 sq. ft. in former mill No. 2 of Clark Thread Co., Passaic Avenue, for new plant.

E. J. Quigley, State purchase commissioner, State House, Trenton, N. J., asks bids until March 3 for quantity of aluminum adjustable traffic signs.

Commanding Officer, Frankford Arsenal, Philadelphia, asks bids until Feb. 27 for 26 rear wheel assembly hubs (Circular 290), and five electric generators (Circular 289).

Collins & Aikman Corp., Fifty-first Street and Columbia Avenue, Philadelphia, has let general contract to H. M. Wilson Co., Eighteenth and Brandywine Streets, for multi-story addition to textile mills, including improvements in present plant, installation of oil-burning equipment for power service, etc. Cost about \$88,000 with equipment.

Philadelphia Scoop & Scale Mfg. Co., 1822 Cadwalader Street, Philadelphia, has taken title to four-story factory at 1817-23 North

Fifth Street, on site, 65 x 283 ft., for new plant.

Bureau of Supplies and Accounts, Navy Department, Washington, asks bids until Feb. 28 for 100 fire extinguishers (Schedule 9586); until March 7, 12,500 sheets of aluminum and 5000 lb. aluminum alloy (Schedule 9657) for Philadelphia Navy Yard.

Philadelphia Macaroni Mfg. Co., Eleventh and Catharine Streets, Philadelphia, has taken bids on general contract for rebuilding part of plant recently damaged by fire. Cost over \$85,000 with equipment. I. W. Levin, 1011 Chestnut Street, is architect.

Pyroglow Signs, Inc., Philadelphia, has been organized by William Z. McLear, Colonial Village, Wayne, Pa., and associates, to manufacture illuminated signs and displays.

Supply Officer, Naval Aircraft Factory, Navy Yard, Philadelphia, asks bids until Feb. 27 for 250 aluminum alloy fuel cocks and 50 valve stems (Aero Req. 922), 100 charging levers, 100 rear-ring post sights, 500 ammunition magazine boxes, etc. (Ord. Req. 518).

Frontier Fuel Corp., River Road, Tonawanda, N. Y., has acquired about 60 acres on River Road, Buffalo, and plans early erection of bulk oil storage and distributing plant. Cost about \$100,000 with steel tanks, pumping machinery and other equipment.

◀ CENTRAL DISTRICT ▶

Latrobe Foundry, Machine & Supply Co. Inc., Latrobe, Pa., has been organized by D. F. Mullane, 292 Kenneth Street, Greensburg, Pa., and associates, to manufacture iron and other metal castings, machine parts and other mechanical products.

Southern Alkali Corp., care of Pittsburgh Plate Glass Co., Grant Building, Pittsburgh, organized several months ago by officials of last noted company and American Cyanamid Co., 535 Fifth Avenue, New York, has begun construction of branch railroad to plant site at Corpus Christi, Tex., and has plans maturing for new alkali plant at that place. Deep water terminals will be constructed. Project will include power house and pumping plant. Cost more than \$7,000,000 with equipment.

Virginian & Western Railway Co., Norfolk, Va., has awarded general contract to Fairbanks, Morse & Co., 900 South Wabash Avenue, Chicago, for new automatic locomotive coaling plant at Justice, W. Va., to handle about 90 tons of coal an hour.

Warren Enameling & Mfg. Co., Warren, Ohio, recently organized by Charles E. Yutzy, George D. Harter Bank Building, Canton, Ohio, and associates, has secured building at Warren for manufacture of enameled iron cooking and kitchenware specialties. Initial capacity will be about 50,000 utensils daily. R. W. Taylor and H. M. Coyle, Canton, will be officials of new company.

Willard Storage Battery Co., East 131st Street and St. Clair Avenue, Cleveland, manufacturer of electric storage batteries, parts, etc., a subsidiary of Electric Storage Battery Co., Philadelphia, has asked bids on general contract for two-story addition, 88 x 200 ft. Cost over \$75,000 with equipment. Company also plans one-story addition to branch plant at Toronto, Ont. Cost about \$35,000 with equipment. Chapman & Oxley, Sterling Tower, Toronto, are architects for last noted unit.

Cleveland Steel Tie Co., Cleveland, care of Day & Day, Standard Bank Building, representatives, has been organized by T. J. Lavan and John M. Conners, Cleveland, to manufacture steel ties and other steel products.

Nathaniel E. Squibb, 2111 Auburn Avenue, Cincinnati, and associates are organizing company to take over former Jackson brewery, Elm and Micken Streets. Present two-story and basement plant will be remodeled and additional equipment installed. Building contract has been let to Pachoud Brothers, 5252 West Eighth Street. Cost over \$60,000 with equipment.

Contracting Officer, Material Division, Wright Field, Dayton, Ohio, asks bids until Feb. 27 for 70 impeller assemblies, rewind drive (Circular 390), 1400 axle fairing clamp assemblies (Circular 391), 80 thermometer assemblies (Circular 407), eight shackle assemblies, bomb (Circular 404); until Feb. 28, brass wood screws (Circular 389); until March 1, 600 air chucks, 16,000 tire valve cores, 1200 valve stem assembly extensions (Circular 392); until March 6, 400 roller bearing assemblies, 440 annular ball bearings, 1425 radial ball

bearings and 95 underground ball bearings (Circular 379), 278 streamline wheel assemblies, 278 stub axle assemblies, 278 brake assemblies (Circular 376); until March 7, one motor-driven bench type milling machine (Circular 400).

Waco Aircraft Co., Troy, Ohio, has secured additional contract from Government of Brazil for 10 war planes, to cost about \$100,000, making total of 69 such type aircraft manufactured for South American countries in past 14 months. Operations will be increased.

Board of School Commissioners, 150 North Meridian Street, Indianapolis, A. B. Good, business director, asks bids until Feb. 28 for new 300-kw. generator-engine unit, with auxiliary equipment for Arsenal Technical Schools, 1500 East Michigan Street.

United States Radio & Television Corp., Marion, Ind., is increasing production schedule and is now giving employment to 600 persons.

City Council, Madison, Ind., plans installation of pumping machinery and other equipment for new municipal waterworks. Cost over \$60,000. John W. Moore, Knights of Pythias Building, Indianapolis, is consulting engineer.

Common Council, Chesaning, Mich., is considering a new municipal electric light and power plant. Cost close to \$70,000 with equipment. Lewis Ruff is engineer in charge.

Ambler Furnace & Foundry Co., Northville, Mich., has been acquired by new interests, headed by Henry Chambers. Company name will be changed to Independent Furnace & Foundry Works, and improvements made.

Landside Shear Co., Unionville, Mich., has been organized by Orson A. Hiser, Unionville, and associates, to manufacture shears and kindred edge tools.

City Council, Allegan, Mich., is arranging fund of \$370,000, proceeds to be used for a municipal hydroelectric power plant and new water system, including pumping machinery and auxiliary mechanical equipment. H. McDougall is city engineer in charge.

Muskegon Plating Works, Muskegon, Mich., has been purchased by new interests, headed by J. G. Morton, Chicago, and associates. Operations will be resumed at early date and production expanded. Company will be known as Muskegon Plating & Rust Proofing Co.

Consumers Power Co., Jackson, Mich., is arranging fund of \$2,973,168 for new construction and improvements, including electric plants and transmission lines. About \$250,000 will be used in gas department for extensions in plants, pipe lines, etc.

Ficks Steel Co., Cincinnati, recently organized, is installing equipment in factory building at 260 West Mitchell Avenue for manufacture of tubular strip furniture. G. J. Ficks is president and general manager.

◀ SOUTH ATLANTIC ▶

Salem Steel Co. Inc., Winston-Salem, N. C., recently organized, has taken over former works of Salem Iron Works, Vagrave Street, for steel fabricating plant. Andrew Birke and J. H. Trotter head new company.

Purchasing and Contracting Officer, Holabird Quartermaster Depot, Baltimore, asks bids until Feb. 27 for pistons, steel wheels, oil pressure gages, wheel studs, carburetors, wrist pins, and other supplies (Circular 76); until March 3, automobile parts (Circular 74), 35 cab assemblies and 35 vacuum tanks (Circular 75).

General Purchasing Officer, Panama Canal, Washington, asks bids until March 6 for meter-testing blocks, conduit fittings, wire and cable, water heaters, transformers, gate valves, pipe and pipe fittings, hand taps, dies, vises, shovels, cold chisels, wrenches, scythe blades and other tools and supplies (Schedule 2841).

William M. Bird & Co., Inc., Charleston, S. C., paints, varnishes, etc., is planning early erection of new plant for manufacture of industrial asphalt emulsions. Installation will include tanks, compounding machinery, pumping equipment and auxiliary equipment. Cost over \$40,000 with machinery.

Norfolk & Western Railway Co., Roanoke, Va., asks bids until March 1 for 100 wrought steel wheels (Contract Serial AA-629).

Marion Mfg. Co., Marion, N. C., is planning electrification of cotton mill, and will install



Courtesy of Cleveland Steel Products Corp., Cleveland, O.

OPERATION: MILLING THREAD ON 1 9/16 IN. SPLINE SHAFT, 20 THREADS
MACHINE: LEES-BRADNER THREAD MILLER.
MATERIAL: S. A. E. 3135 STEEL
CUTTER: 3 IN. R. P. M. 156.
PRODUCTION: 30 PIECES PER HOUR
LUBRICANT: 1 PART SUNOCO TO 15 PARTS WATER



Courtesy of Cincinnati Grinders, Inc., Cincinnati, O.

OPERATION: ROUGH AND SEMI-FINISH GRIND ON GRINDING WHEEL SPINDLE.
MACHINE: 14 IN. BY 48 IN. CINCINNATI PLAIN SELF-CONTAINED GRINDER.
MATERIAL: S. A. E. 3145 STEEL.
STOCK REMOVAL: .030 INCH.
LIMITS: PLUS, .0000 INCH. MINUS, .0002 INCH.
TIME PER PIECE: 35 MINUTES.
COOLANT: 1 PART SUNOCO TO 40 PARTS WATER.

AIDS IN REDUCING COSTS

Production held up—time lost in frequent changing and resharpening of tools—rejects excessive due to faulty finish and inaccurate tolerances, all because one factor—the cutting lubricant which is essential to the machining process, fails to live up to its promised performance.

Even in these days of emphasis on price, it is of greater importance that you have full confidence in the sustained quality of the cutting lubricant you purchase.

The ability to estimate the production capacities of cutter, drills, forming tools, etc., is an invaluable aid in com-

puting manufacturing costs. The uniformity of Sunoco Emulsifying Cutting Oil will permit accurate predictions on the quantity of work your machine tools will produce.

Sunoco minimizes idle time by increasing the number of pieces produced between grinds.

When used on Abrasive Machine Tools, Sunoco will permit faster cutting, longer wheel life and consequent greater production.

Machine Tools operating with Sunoco give constant, uniform production with but little attention from the operator.

SUN OIL COMPANY, PHILADELPHIA, PA., U.S.A.

SUN OIL COMPANY, LTD., Montreal, Canada.

BRITISH SUN OIL COMPANY, LTD., London, England.

SUNOCO
 EMULSIFYING
CUTTING OIL

Made by the producers of BLUE SUNOCO MOTOR FUEL

Akron, Albany, Allentown, Atlantic City, Baltimore, Battle Creek, Beaumont, Bridgeport, Buffalo, Chicago, Cincinnati, Cleveland, Columbus, Dallas, Dayton, Detroit, Flint, Grand Rapids, Harrisburg, Jackson (Mich.), Jacksonville, Miami, Montreal, Newark, New York, Philadelphia, Pittsburgh, Providence, Reading, Rochester, Scranton-Wilkes Barre, Syracuse, Tampa, Toledo, Toronto, Trenton, Tulsa, Wilmington, Youngstown and London, England.

new equipment in different departments. Cost about \$80,000 with machinery.

Bureau of Yards and Docks, Navy Department, Washington, asks bids (no closing date stated) for condensers and auxiliary equipment (Specification 7231) for New York and Portsmouth, N. H., Navy Yards; until March 8, one 800-kw. synchronous motor-generator set and accessory equipment (Schedule 7228).

Abbeville Power Co., Abbeville, S. C., care of J. Roy Pennell, 134 Pine Street, Spartanburg, S. C., recently organized by Mr. Pennell and associates, has secured permission for erection of hydroelectric generating plant on Rocky River, near Lownesville. Project will include transmission line to Abbeville, Antreville, S. C., and vicinity for light and power service. Cost about \$175,000. Mees & Mees, Court Arcade, Charlotte, N. C., are consulting engineers.

Bureau of Supplies and Accounts, Navy Department, Washington, asks bids until Feb. 28 for 19,290 ft. lighting and power cable (Schedule 9649), one table saw (Schedule 9547), one table router (Schedule 9549), electric motors, control equipments and spare parts (Schedule 9660) for Eastern and Western yards; 202,698 lb. copper nickel alloy tubes (Schedule 9626) for Boston, New York, Philadelphia and Puget Sound yards; until March 7, 68,100 lb. sheet steel (Schedule 9639) for Norfolk Navy Yard; corrosion resisting steel valves (Schedule 9591), air ejector sets and spare parts (Schedule 9611), metal propeller blades and hubs for airplanes (Schedule 9629), water gage glasses (Schedule 9642) for Eastern and Western Yards; 4498 oilers and oil fillers (Schedule 9641) for Philadelphia, Boston, Mare Island, San Diego and other yards.

SOUTH CENTRAL ▶

Emory Pipe & Foundry Co., Anniston, Ala., has filed plans for one-story foundry, 164 x 264 ft., to replace part of plant recently destroyed by fire. Cost over \$80,000 with equipment.

Constructing Quartermaster, Maxwell Field, Montgomery, Ala., asks bids until March 1 for construction of gas and water distributing systems, including pipe lines, etc.

Board of Trustees, Louisiana State University, Baton Rouge, La., James M. Smith, president, is planning addition to power plant, including additional equipment; also new mechanical arts and science building. Work will be carried out in connection with expansion program to cost over \$1,000,000.

Continental Can Co., Harvey, La., is running on full time production schedule at new local plant, completed a few months ago, giving employment to large working force. Factory has rated capacity of 1,000,000 cans daily.

United States Engineer Office, Memphis, Tenn., asks bids until March 1 for 12 manganese steel castings (Circular 455).

Board of Trustees, State Penitentiary, Parchman, Miss., plans rebuilding oil-operated light and power plant, recently destroyed by fire. Loss about \$25,000 with equipment.

MIDDLE WEST ▶

Signal Corps Procurement District, 1819 West Pershing Road, Chicago, asks bids until Feb. 28 for heat coils, switchboard keys, plugs, cast iron caps, etc. (Circular 26).

Metropolitan Utilities District, Eighteenth and Harney Streets, Omaha, Neb., is planning extensions and improvements in artificial gas plant, including installation of turbine-driven booster pump, capacity about 750,000 cu. ft. an hr., gas scrubber and auxiliary equipment. Cost about \$60,000. F. A. Leisen is general manager.

American Brewing Co., Great Falls, Mont., will carry out an expansion and modernization program at brewing plant, including installation of additional equipment. Cost over \$50,000 with machinery.

Bureau of Reclamation, Denver, asks bids until March 8 for one motor-driven pumping unit, with accessories.

Golden-Denver Metropolitan Mutual Water Association, care of Frank N. Bancroft, University Building, Denver, plans installation of pumping plants, booster stations, pipe lines and other equipment for waterworks system at Golden, Arvada, Wheatridge and vicinity. Entire project to cost over \$2,000,000. Douglass & Thwaits, Wilda Building, and Ralph I. Meeker, 1669 Broadway, both Denver, are consulting engineers.

Quartermaster, Fort Francis E. Warren, Wyo., asks bids until March 1 for extensions in gas and water distributing system, including pipe lines, etc. (Circular 3).

Big Diamond Mills Co., Chamber of Commerce Building, Minneapolis, Minn., plans rebuilding of portion of flour mills and elevator at Morristown, Minn., destroyed by fire, Feb. 6. Loss over \$65,000 with equipment.

Fredericks Armature Corp., Chicago, has been organized by Saul H. Groner and others, to operate an electrical motor repair and rebuilding works. Company will take over organization of same name at 1315 South Wabash Avenue.

Blower Application Co., Milwaukee, has been incorporated by Charles H. Jackson, W. J. Janssen and W. C. Kussmaul, 1752 North Fifty-first Street, to manufacture and install air conditioning, heating and dust collecting equipment.

Public Utilities Commission, 817 Franklin Street, Manitowoc, Wis., has placed general contract for new water supply, complete with pumps, motors, etc., with Gray-Milneer Co., 1125 North Thirty-fifth Street, Milwaukee, at \$29,500.

NEW ENGLAND ▶

Bureau of Yards and Docks, Navy Department, Washington, asks bids until March 1 for two 300-hp. watertube boilers, superheaters, pulverized fuel equipment and accessories (Specification 7158) for Portsmouth, N. H., Navy Yard.

Broad of Trustees, City Hospital, 818 Harrison Avenue, Boston, is considering installation of an electric light and power plant, using Diesel engine units, for service at Boston Sanatorium. Cost about \$25,000. Elliott Earl, consulting engineer for municipal light committee, City Council, City Hall, is in charge.

Sentry Mfg. Co., Inc., Providence, R. I., has been organized by Frank St. Angelo and F. A. O'Donnell, 163 Lockwood Street, to manufacture metal products.

Burnham & Morrill Co., Portland, Me., manufacturer of canned food products, is planning to rebuild part of plant on Water Street recently destroyed by fire. Loss about \$40,000 with equipment.

Victor A. Rostow, Inc., New Haven, Conn., has been organized by Victor A. Rostow, 821 Orange Street, and associates, to manufacture metal toys and kindred products.

SOUTHWEST ▶

Freedman Piston Corp., St. Louis, recently organized to manufacture a patented piston ring expander and kindred products, has leased space at 2315 North Ninth Street for new plant. Louis Freedman is head.

Common Council, Clarkton, Mo., plans installation of a 50,000-gal. capacity steel tank on 125-ft. steel tower, pumping machinery and other equipment for waterworks extensions and improvements. W. A. Fuller Co., 2916 Shenandoah Avenue, St. Louis, is consulting engineer.

Automatic Valve Controls Corp., St. Louis, care of C. L. Wait, 3934 Palm Street, St. Louis, recently organized by Mr. Wait and associates, plans establishment of plant at Tulsa, Okla., for manufacture of line of patented valves for use on oil, gas and other pipe lines.

Common Council, Burlington, Kan., has report from E. T. Archer & Co., New England Building, Kansas City, Mo., consulting engineers, for municipal electric light and power plant to cost about \$85,000 with equipment, and power distributing system to cost \$33,000. Bids will soon be asked.

Solid Steel Scissors Co., Fort Smith, Ark. H. J. Miller, president, is running on a full capacity, five-day week schedule, giving employment to about 150 persons.

Contracting Officer, Quartermaster Corps, Fort Riley, Kan., asks bids until Feb. 27 for bolts, washers, bandsaw blades, springs, locks, wire, switches, screws and other supplies (Circular 36).

Board of Education, Fort Worth, Tex., plans manual training department in new multi-story John L. Long junior high school, for which superstructure will soon begin. General contract just let to Ball Construction Co., Fort Worth, Tex. Cost about \$225,000.

Fort Worth Steel & Machinery Co., Fort Worth, Tex., is adding to line of production, including elevating and conveying machinery and power transmission equipment. Other output comprising sheet metal equipment, cotton oil mill machinery, etc., will be continued as heretofore.

Southern Bronze Mfg. & Plating Co., Houston, Tex., has been organized by R. H. Mitchell, Houston, and associates, to manufacture bronze and other metal products, and operate general metal plating works.

PACIFIC COAST ▶

Board of City Trustees, Sonoma, Cal., plans installation of two electric-operated pumping units, each about 250-gal. per min. capacity, and other equipment for new municipal water system. Fund of \$33,000 is being arranged for work and bids will be asked soon. Hussey & Belcher, Syndicate Building, Oakland, Cal., are consulting engineers.

Bureau of Yards and Docks, Navy Department, Washington, asks bids until March 1 for new balloon hangar at naval air station, Sunnyvale, Cal. (Specification 7027).

Board of State Harbor Commissioners, Ferry Building, San Francisco, has plans for extensions in refrigerating plant and terminal, Channel Street. Cost about \$60,000 with equipment. Frank G. White, address noted, is engineer.

Bureau of Supplies and Accounts, Navy Department, Washington, asks bids until Feb. 28 for one tilting bench saw (Schedule 9604); until March 7, one pedestal type grinder (Schedule 9613), one oil-grooving machine, all motor driven (Schedule 9643), 12 automatic temperature regulator valves and spare parts (Schedule 9612) for Puget Sound Navy Yard; naval bar brass (Schedule 9628) for Mare Island Navy Yard.

Walla Walla Canning Co., Walla Walla, Wash., J. G. Kelly, president, has arranged fund of about \$45,000 for erection of new fruit canning plant on local site.

Bureau of Reclamation, Denver, asks bids until March 1 for hydraulic machinery for Hoover Dam power plant, Boulder Canyon, Nev., including two vertical shaft 115,000-hp. hydraulic turbines, with pressure regulating valves and auxiliary equipment; two 55,000-hp. hydraulic turbines, with pressure regulating valves, etc., governors and accessories (Specification 540).

R. M. Tarr, Boise, Idaho, is at head of project to erect a new smelting plant near city, and new company, Idaho Smelting & Processing Co., will be organized to carry out program. Initial unit will cost over \$60,000. Company proposes to establish an oil refinery later.

FOREIGN ▶

Ministry of Public Works, Cairo, Egypt, asks bids until May 10 for electrical equipment for Aswan hydroelectric generating plant, including turbine units, electric alternators, transformers, switchboards, cable and other equipment.

Manchester Corp., Gas Department, Manchester, England, is planning erection of two new plants for extraction of benzol from coal, using finished product as motor fuel. Units will be built in conjunction with local gas plants. Cost over \$350,000 with machinery.

Ministry of Interior, Cairo, Egypt, asks bids until March 1 for pumping machinery, including two medium pressure and two low pressure centrifugal pumps with accessory equipment, one well pump, one piston pump and other units.

South Manchuria Electric Co., Mukden, Manchuria, a subsidiary of South Manchuria Railway Co., same place, is planning three new power plants at Tenchi, Sifeng and Tunkua, Manchuria, respectively. Cost over \$500,000 with transmission lines, substations and other structures.

Trade Notes

Davis & Thompson Co., 6619 West Mitchell Street, Milwaukee, machinery manufacturer, has appointed Riordan Machinery Co., 213 Curtis Building, Detroit, to replace Cadillac Machinery Co. as its representative in the Detroit district.

Wrought Iron Billets.—A. M. Byers Co., Pittsburgh. Leaflet devoted to description and specifications of genuine wrought iron forging billets. Standard classification and size extra list is included.

Cadillac Machinery Co., 623 Fisher Building, Detroit, has been appointed exclusive dealer in the Detroit territory by Bryant Machinery & Engineering Co., Chicago.

Bids will be taken soon for repairing south jetty at mouth of Columbia River, Oregon, which will require 170 tons of bolts and spikes and 650 tons of steel rail.

Modern Beam Arch Construction Made this a Better Field House



Field House, University of Chicago:
Length, 374'-2". Width, 168'-2". Height
to top of beam at center, 68'-0". Architects,
Holabird & Root. Associate architect,
Emery B. Jackson.

THE new Field House at the University of Chicago illustrates clearly some of the advantages of the special Beam Arch—as developed by the American Bridge Company—over the conventional arch truss construction. Larger clearances, both vertically and horizontally, for a specified roof height, or lessened height of sides and gables for specified clearances, will be recognized as an economy having importance in assembly halls, gymnasiums, rinks, hangars, and other buildings where large unobstructed space is required. Full information and estimates will be supplied on request.

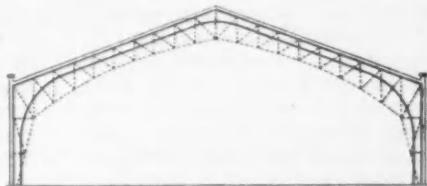


Diagram No. 1. For specified height of roof,
increased side and vertical clearances.

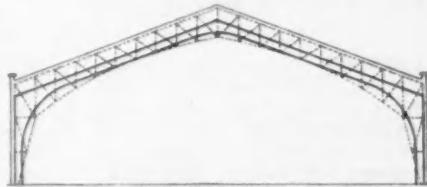


Diagram No. 2. For specified clearances,
lessened heights of side and gable walls.

*Fabricators and Erectors of all classes of Steel Structures: Bridges, Buildings,
Towers, Sub-stations, Barges, Turntables*



AMERICAN BRIDGE COMPANY

General Offices: Frick Building, Pittsburgh, Pa.

SUBSIDIARY OF UNITED STATES STEEL CORPORATION



*Contracting Offices: Baltimore, Boston, Chicago, Cincinnati, Cleveland, Denver, Detroit, Duluth,
Minneapolis, New York, Philadelphia, Pittsburgh, St. Louis, Salt Lake City.*

Pacific Coast Distributors: COLUMBIA STEEL COMPANY, San Francisco, Los Angeles, Portland, Seattle.

Export Distributors: UNITED STATES STEEL PRODUCTS COMPANY, New York, N. Y.

Practical Methods for Heating Solids by Induction

(Concluded from Page 311)

ingenious and effective mechanical device was initiated and constructed by the Heppenstall company.

The inducing current is supplied at 960 cycles from their 150 kw. high frequency generator equipment which was installed by them and is chiefly used for melting high-grade steels.

Versatility of Inductive Heating

Modern developments of electron tubes, gap oscillators, inductor-type generators and wire-wound generators make possible the production of alternating and oscillatory currents of many amperes and at frequencies ranging from one meter wave length to thousandths of kilometers. The perfection of the power condenser makes it possible to so arrange circuits that the generator of a high or medium frequency e.m.f. need supply the power component only of the kva. developed. As frequencies are made higher and higher, inductive effects, both electromagnetic and electrostatic, become more and more pronounced. Ultimately all power generated is either radiated into space or converted into heat.

Other Uses Suggested

The technical means of doing these things have been so perfected and the efficiencies in making desired energy transformation have been so improved that it may be said that all heating of every kind can be done by induction and very frequently with economies which justify its use in industry. In addition to the inductive processes for heating solids [discussed in this paper] may be listed the following which are but a very few of those which have been brought to my notice:

- (a) Removal of tires from locomotive wheels;
- (b) heating brake drum rims while revolving and being filled with molten cast iron;
- (c) heating ends of valve castings for upsetting and forging;
- (d) heating bolt stock before entering heading machine;
- (e) heating nickel-chrome billets, rods and wire for swaging, reduction by rolling and wire drawing;
- (f) heating ends of shafts to be butt-welded;
- (g) heating rings, etc., for making shrink fits;
- (h) heating ball bearing races for hardening;
- (i) heating ends of large-diameter billets for upsetting or forging;
- (j) heating tool-steel dies;
- (k) heating central region of disk auto wheels for punching.

The above list might be lengthened until it included a very large cross-section of modern industrial processes which employ medium and high temperatures.

The general character of material to which inductive heating may be

best employed may be summarized thus:

- a. The metal pieces to be heated best should have a certain symmetry of form.
- b. Large diameters are favorable to the inductive method.
- c. Magnetic metal is cheaper to heat than non-magnetic.
- d. The ratio in economies of inductive to fuel heating increases with increase in the final temperature demanded.
- e. For extremely fast heating, the inductive method is unexcelled.
- f. Localized heating of a part of a large metal piece is most readily accomplished by induction (arc heating excluded).

A Vision of the Future

I SEE realized in due time a far-flung development in Detroit, in Pittsburgh, in Cleveland, in Chicago, in all great industrial centers, where vast numbers of kilowatts are used daily for forging, for annealing, for normalizing thousands of tons of metal and for melting other thousands of tons of ferrous alloys, and all manner of non-ferrous metals. What is this development?

At a centralized great generating station, run with coal, gas or water power, I see huge generators, direct-connected to prime movers, which supply to a widely spread network carried in multiple cables under a single sheath, polyphase, 1000-cycle power. I see this power going to every important place where lighting and heating of any kind whatever is done.

I see every melting unit and every type of muffle furnace, every billet and sheet heater, every odd and special type of laboratory and commercial inductive heater, permanently fitted with its unchangeable quota of corrective capacity to bring the phase to near unity on the incoming lines. I see a moderate-sized bank of capacitors in the great power house, the units of which automatically switch on and off to take all the burden of the wattless component of the kva. on themselves and leave the great thousand-cycle machines the duty of supplying power only—power which flows out from the central station to be wholly consumed in a countless variety of useful, cleanly, efficient and controllable heating and lighting devices.

No more in the region supplied will metals and alloys be poisoned with deleterious matter, and no more will hundreds of tons of surface oxides fall from heated steel.

This vision must become reality, for it is sound engineering, it is good economy, it is efficiency, it is progress.

Threading Dies—Their Manufacture and Cutting Efficiency

(Concluded from Page 315)

blanket to protect the metal underneath. If the hardening has been properly conducted, much of the scale will begin to jump off during the period where the tool is becoming hard or changing from austenite to martensite.

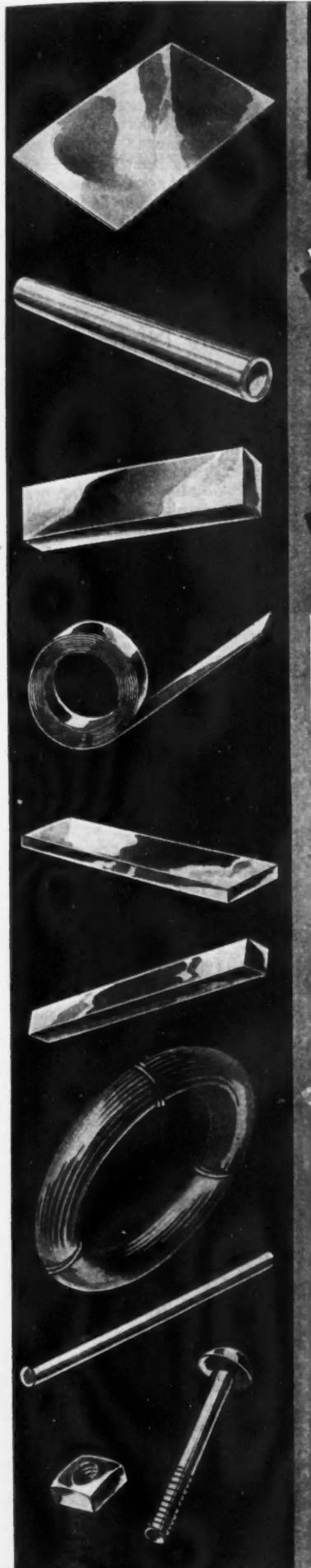
Another influence of nickel affecting the refractoriness of threading dies is the tendency on the part of threading tools to sweat more readily. Sweat beads tend to form in the threads more quickly than in steels of low nickel content. We have observed one case of a steel containing 0.19 per cent nickel where the tendency to form sweat beads in the threads was more noticeable than in steels containing under 0.10 per cent nickel. The 0.19 per cent nickel heat did not show any other detrimental characteristics and the tops of the teeth were file hard. As no complete study was made of this material we may not be justified in laying the blame to nickel. However, in view of our present findings some suspicion is placed on the nickel as a contributing cause.

Carburization Also Harmful

Both carburization and decarburization of the fine edges of chasers may prove detrimental. Abnormal decarburization will cause rapid wear and abnormal carburization will induce brittleness. Ordinarily in the hardening of high-speed steel the tendency is to a slight decarburization. Under certain flame conditions the teeth of chasing tools may absorb some carbon from the furnace gases. The absorption of carbon by the fine, sharp teeth seldom occurs but is by no means unusual. Threading tools that are quenched in air give practically no trouble from this source, as the scaling during cooling will remove 0.002 to 0.005 in., or enough to remove a carburized zone if present.

Threading dies which have absorbed carbon in the points of threads invariably show typical overheated structures. Fig. 1 is a micrograph of a 28-pitch thread taken at 1000 diameters. The chaser was hardened from a gas-fired furnace at approximately 2250 deg. F. and drawn at 1050 deg. F. for one hour. The micrograph shows, on the lower part, a structure approaching normal, blending into a zone of considerable needle martensite and massive martensite above. The tip of the tool consists of massive martensite and massive carbide. The white area has resisted tempering to a considerable degree. Carbon has been absorbed on the tops of the threads.

Micrograph, Fig. 2, taken at 500 diameters, is the tip of a thread of a 14P. chaser that was experimentally



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hardened from a liquid bath at approximately 2225 deg. F. and rehardened without previously annealing from a liquid bath at 2300 deg. F. (1½ min. in bath). Tool drawn at 1050 deg. F. Sample etched 2 min. in 5 per cent nital. The body of the tool showed effective tempering after etching for one minute. The "overheated" tips of the teeth show little attack after 2 min. etching. The liquid bath was probably contaminated by some carbonaceous material, as chasers made from the same steel, but hardened from 2300 deg. F. only, on a previous date did not show any overheating of the threads.

An experimental lot of 14P. and 16P. chasers which had been rehardened from a liquid high heat bath, and which showed the above condition of "overheating," were annealed in lead at 1480 deg. F. for 20 min. Analysis of the 0.008 in. milled from the tops showed the threads to analyze 0.87, 0.89, 0.89 and 0.89 per cent carbon. The heat and bar analysis each showed 0.70 per cent carbon. During the hardening and rehardening, an absorption of 0.17 to 0.19 points in carbon had taken place. This local "overheating" appeared to affect the points only. In no case have we ever observed needle martensite at the root of threads.

From the foregoing data it will be seen that either a pickup in carbon or a decarburization during the heat treatment of fine-edged high-speed steel tools is accelerated as the surface area becomes great as compared to the mass of metal. It is generally known that high-speed steel may be decarburized in heat treatment through the use of a so-called oxidizing atmosphere. Fig. 3 is a typical structure of a thread which has been subjected to an oxidizing furnace atmosphere. It is equally true that an improper furnace atmosphere may induce an absorption of carbon which is detrimental to the performance of fine edged tools.

Furnaces with Regulated Atmospheres

A short time ago the writer heard an eminent authority on case carburizing make the statement that it will not be long before nearly all high-speed steel hardening furnaces are equipped with CO₂ recorders, the purpose being to maintain the optimum CO and CO₂ gas ratio. This would appear to be a logical development in the future treatment of high-speed steel. The various phases which make up the 2350 deg. F. atmosphere in which high-speed steel tools are heated for hardening have in themselves a great bearing on the quality of work produced.

We believe the future will see the hardening of fine-edged high-speed steel tools done in furnaces, the atmospheres of which are maintained according to prescription. Only then will it be possible to definitely control the antics of carbon which can be both saint and sinner to sharp-pointed high-speed steel tools.

Reducing Polishing Costs by Tumbling

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from 20 to 30 r.p.m., but the horizontal iron barrels are run at from 25 to 35 r.p.m. or even higher.

Duration of Wet Sand Run Varies

The duration of a run in wet sand varies widely in different plants. Twelve hours may be considered sufficient for brass or bronze, whereas a good clean malleable-iron casting may require three times this period of time, and a coarser cast-iron part may need as high as 70 to 80 hr. to break down the hard scale and produce the desired finish. Since these long operation times tie up considerable equipment and cause halts in the orderly process of work through the plant, it is readily to be seen that it will pay to spend the time necessary to learn the most economic mixtures of parts, rolling media, abrasives, and tumbling speeds. In plants doing this work regularly past experience with other parts permits quick and fairly accurate judgments. Barrels operating at different speeds should be available, or a method provided for shifting the speed of a barrel. It is a mistake to have all barrels operating at uniform speeds, as is sometimes the case.

Balancing the time between the ball or slug rolling and the sand rolling requires close observation. Furthermore, overall time can be saved by mixing parts in the first rolling as mentioned above. Where small castings can be tumbled with larger ones the separate time normally needed to roll the smaller work can be saved. In the sand rolling it is not necessary to change from a coarse sand to a fine grade because the sand itself will break down and produce a finer finish as the operation proceeds. It is not practical to use the sand over again, as its coarse cutting qualities are destroyed.

Savings from Intelligent Study of Methods

Tumbled parts require a light acid pickle before plating or lacquering. Brass and bronze castings after the wet rolling, and following the acid dip, may be rolled further in balls with a soap and sodium cyanide solution. The tumbling process is likely to work-harden the surface of iron and steel parts, but this is usually an advantage rather than an injury.

The success of tumbling as applied to the finishing of parts in the average plant will depend upon the ingenuity of the foreman and supervisors. Many parts for office and household machines, on which hand polishing and buffing were formerly considered necessary, have lately been tumbled satisfactorily. Such parts as handles, levers, and finger grips can be completely tumbled in barrels and

then hand wiped on a polishing wheel at the point where a high smooth luster is desired. The polishing department has too frequently been a place that management has passed by on trips of economy-seeking through the plant. Much hand polishing can be eliminated or reduced by intelligent study of tumbling methods. Limits are sometimes set on the size and weight of parts that can be tumbled, but the limiting factor is actually the size of the barrels since the same principle applies regardless of the size of work.

Machining Nickel-Steel Helical Gears

(Concluded from Page 309)

lapped. From this machine the gears are passed by hand through a window into a small sound-proof room, a number of which flank the lapping machines. This arrangement saves both time and space and makes it unnecessary for the lapping machine operator or the tester in the silent room to move out of his tracks.

Gears are mated in the sound proof room and are tested on two speeding machines to see that they pass the strict specifications calling for absence of noise. After being subjected to this severe test, they go to the transmission assembly department.

A patented eyepiece for the spectroscope, designed to show the spectrum line of a minor element present in a substance under investigation in such a way that the intensity is a measure of the relative proportion of the element in the combination, has been developed by Adam Hilger, Ltd., 98 Kings Road, Camden Road, London, N. W. 1, England. The Spekker Steeloscope, the specialized form of spectroscope for ascertaining the quantities of the components of, say, an alloy steel, is now listed complete with the Insta eyepiece, as the attachment is called.

Carpenter Metal Products Co., Cleveland, has been organized with R. F. Carpenter, formerly president of the Sanymetal Products Co., as president and treasurer, Ed Welles as vice-president and M. H. Ralph, secretary, to manufacture metal partitions and a line of metal specialties. The company will occupy quarters in the former Walker Motor Co. Building, 13001 Taft Building, N. E.

Flaws and cracks in tungsten or molybdenum wire, copper tubing and similar materials, are detected by a new vacuum tube oscillator developed by the General Electric Co. This device has already been found of great value in the manufacture of General Electric products where the visual detection of small defects is a very slow process, requiring extreme care.